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Self- and Peer-ratings of Self-esteem and Cardiovascular Reactivity to Laboratory Stressors in Cadets

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Abstract

Past research has indicated that self-esteem has multiple dimensions. It has been suggested that defensive high self-esteem makes one vulnerable to ego-threat and might be reflected in discrepancies between peer- and self-ratings. The purpose of this study was to observe how self- and peer-rated self-esteem affect cardiovascular reactivity to ego-threatening stressors (cold pressor and toughness-challenging interview) in nineteen military college cadets. High/low groups of self-esteem were formed based on peer- and self-ratings. Cadets in the low self-rating group showed evidence of a mixed (myocardial and vascular) response; cadets in the high peer-rating group showed higher myocardial and lower vascular reactivity. Cadets with high peer-/low self-ratings (defensive high self-esteem) had a greater blood pressure increase during interview preparation than participants with high peer-/high self-ratings. The present findings suggest that secure high self-esteem, as reflected by agreement between self- and peer-ratings, may be the only way to ensure low vulnerability to stress.

Keywords: self-esteem, self-ratings, peer-ratings, cardiovascular reactivity, defensive, stress, myocardial, vascular, toughness, masculinity

Introduction

Society has become more preoccupied with self-esteem since the birth of the "me" generation (born between 1982 and 2002; Belkin, 2010). This can be evident anywhere from quizzes in popular magazines to empirical research studies in academic journals. For instance, a search of the academic literature from 1982 to present on self-esteem yielded 32,441 citations, compared to only 5,088 prior to 1982. While the layperson usually has a dichotomous (i.e., high and low) perspective of self-esteem, past studies have suggested self-esteem has multiple dimensions (Kernis, 2003).

There is evidence that *high* self-esteem, in particular, can be categorized into two subtypes, secure and fragile self-esteem (Kernis, 2003). Secure self-esteem is characteristic of individuals who demonstrate a well-grounded and satisfactory view of themselves, whereas fragile self-esteem typifies individuals who are more tenuous and susceptible to ego-threat and engage in attempts to defend and augment their high self-esteem (Kernis, 2003).

A subdimension of fragile high self-esteem is defensive high self-esteem, defined by an inconsistency between one's inner feelings of self-worth and outward appearance (Kernis, 2003). Savin-Williams and Jaquish (1981) found that "presented self" (e.g., peer-rated self-esteem) and "experienced self" (e.g. self-rated self-esteem) were not significantly associated with each other and proposed that this difference was due to defensiveness (p. 324). Salmivalli, Kaukiainen, Kaistaniemi, and Lagerspetz (1999) allude to the possibility of measuring defensive high self-esteem by examining differences between individual and peer-ratings. Defensive self-esteem, defined as high scores on defensive egotism as well as high self- and peer-ratings of self-esteem, was associated with bullying behavior in adolescents. However, elsewhere high peer- and low self-ratings of personality traits have been suggested as indicative of unconscious repression when the trait is an undesirable one such as hostility, whereas high self- and low peer-ratings may reflect conscious suppression of the objectionable trait (Davidson, 1993).

According to Lazarus' (1991) theory of stress and emotion, for a situation to be appraised as stressful it must be ego-involving (i.e., goal relevant). Some specific types of ego-involvement proposed by Lazarus are those pertaining to situations relevant to social- and/or self-esteem where the ego must be defended.

Similarly, within the cardiovascular stress-reactivity literature, the extent to which an individual is engaged or involved in a laboratory stressor (i.e., the stressor is ego-relevant) is a major determinant of his or her responsiveness (Saab, Kline, & McCalla, 2007; Singer, 1974). Cardiovascular reactivity is typically defined as a change in a cardiovascular variable [e.g., blood pressure, heart rate (HR)] from baseline to a stressor. This is important because the "reactivity hypothesis" states that individuals who regularly exhibit inflated cardiovascular responses to stressors may be at a greater risk of developing hypertension or heart disease (Saab et al., 2007). Two main types of cardiovascular responses include myocardial reactivity, which is increased blood pressure due to an elevated cardiac output (CO), and vascular response, defined as increased blood

pressure resulting from heightened total peripheral resistance (TPR). Typically, diastolic blood pressure (DBP) tends to be especially associated with an increase in TPR. There is emerging evidence that vascular reactivity may be more detrimental than myocardial responses (Kapuku et al., 1999).

While a variety of personality traits have been linked to cardiovascular reactivity, self-esteem has been understudied and no research has examined defensive self-esteem in relation to reactivity. However, there have been studies that have narrowed their foci on reactivity in association with defensiveness, alone (for review, see Rutledge, 2006), or in conjunction with other personality variables [e.g., hostility (Davidson, 1993; Helmers et al., 1995), anxiety (Weinberger, Schwartz, & Davidson, 1979)]. While defensiveness has been reliably linked to greater reactivity, studies have been inconsistent in terms of whether conscious suppression or unconscious repression of other personality traits is associated with greater response. In a classic investigation, Weinberger et al. (1979) examined repressed anxiety, defined as low trait anxiety combined with high defensiveness (as measured by the Marlowe-Crowne Social Desirability Scale: Crowne & Marlowe, 1960). Repressors demonstrated greater HR responses to a phrase association task than true high anxious (high trait anxiety, low defensiveness) individuals. In accordance with our current study on self- and peer-ratings, Davidson (1993) has found suppressors of hostility (high self, low other ratings) to show an increase in systolic blood pressure (SBP) in response to a structured interview.

When evaluating personality traits that have been linked to cardiovascular reactivity to stressors in the laboratory, it is important to use stressors that are relevant to the expected personality trait (Saab et al., 2007). The purpose of the present study was to observe the effects of self- and peer-ratings of self-esteem on cardiovascular reactivity to stressors that challenge self-esteem. For cadets at a military college who are accustomed to a spartan lifestyle, situations that challenge their toughness may be particularly salient to their self-esteem.

In determining how to operationalize dimensions of self-esteem in the present study, we considered Davidson's (1993) definition of conscious suppressors of hostility as individuals who report and, consequently, are presumably aware of their *high* levels of this undesirable characteristic but conceal it, resulting in low peer-ratings. However, because *low* levels of self-esteem are socially undesirable, in our view, participants who self-report low self-esteem while being rated high in self-esteem by their peers (hereafter referred to as defensive high self-esteem) are best conceptualized as consciously suppressing or concealing their low self-esteem. Conversely, those who rate themselves high in self-esteem, but are rated low by their peers, might be best understood as unconscious repressors who have deceived themselves into believing they have high self-esteem when, in reality, they most likely do not.

While this study was exploratory in nature, in light of Davidson's (1993) finding of suppressors of hostility exhibiting the greatest SBP reactivity, we hypothesized that our defensive high self-esteem group would show the largest increase in one or more cardiovascular measure.

Method

Participants

Nineteen normotensive cadets from the Virginia Military Institute (VMI) participated in the current study. Demographically, there were 15 men and 4 women (15 Caucasians, 3 African Americans, 1 Latino-African American) ranging between 18 and 23 years of age (M = 20.6). Cadets volunteered to earn partial credit in courses offered in the Department of Psychology and Philosophy or the Department of Physical Education for their participation.

Procedure

In this study, a primary experimenter of the same gender tested each participant individually. The participants were asked to refrain from exercise for 2 hours and from alcohol, caffeine and nicotine products for 3 hours prior to their scheduled appointment. If cadets were using cardioactive medication, they were asked to abstain or were rescheduled.

Upon arrival, cadets confirmed their compliance with study restrictions, provided informed consent, and completed a packet of questionnaires. These included demographic, personal and family medical history information forms, as well as a variety of personality tests. Height and weight were then recorded and the participant was guided to the experimental room.

The cadet was asked to stand while the experimenter prepared his or her neck and sides of the abdomen with alcohol and a mildly abrasive pad. In order to record the impedance cardiogram (for derivation of measures contributing to myocardial and vascular responses) and electrocardiogram, a pair of surface electrodes was placed on both sides at the

base of the neck and another pair was attached 5 cm above the first. A third pair of electrodes was then applied on both sides of the chest (i.e., the rib cage), on the midaxillary line at the level of the xiphoid process, with a fourth pair placed 5 cm below them. The cadet was asked to take a seat and was then fitted with an Eclipse (SunTech Medical, Morrisville, NC) automated blood pressure cuff on his or her right arm. Next, the electrocardiographic and impedance cardiographic signals were checked and an initial blood pressure was recorded. If the participant's blood pressure was ≥ 140 mmHg/90 mmHg, a second reading was taken. If the average of these two readings was ≥ 140 mmHg/90 mmHg, then the cadet was excluded from the study, which occurred in only two cases. The remaining participants received final instructions before the first rest period.

The testing phase consisted of a 5-minute resting baseline period, a 2-minute cold pressor task, an 8-minute recovery period, a 1-minute interview preparation period, a 3-minute interview, and a final 8-minute recovery period. Task order was counterbalanced. At the conclusion of the testing phase, the blood pressure cuff and electrodes were removed and participants were debriefed. Prior to departing, the cadets were asked to provide an email address of a friend who would be willing to fill out a 10-item questionnaire. They were not aware that their friends would be using the same questionnaire to rate the participants' self-esteem as they had earlier used to rate themselves. Self-esteem questionnaires were emailed to the participants' friends within 2.5 weeks of the study. Data used for this study are part of a larger data set and represent the 19 students for whom their friends completed the 10-item questionnaire.

Laboratory stressors

Cold pressor test

This version of the cold pressor test involved the participant submerging his or her left foot in a plastic tub, containing a 4° C mixture of ice and water, for 120 seconds.

Toughness-Challenging Interview (TCI) preparation

A unique contribution of this study was the introduction to the psychophysiological literature of a new laboratory stressor, the TCI. The following instructions for the TCI preparation period were read by the experimenter to the participant:

OK—I would like you to tell me about a time in your life, prior to coming into the laboratory today, when you felt weak or like your manhood [this term was only used for male participants] or toughness was challenged. Try to choose the time in your life when you felt the most like this—that is, when you felt the weakest you have ever felt or when you felt like your manhood or toughness was challenged the most it has ever been. Your experience does not have to be something that happened while at VMI, but let me give you some examples of such experiences that might happen to male [or female] cadets.

The participant was shown a list of toughness-challenging situations, some specific to VMI. The experimenter then read the following instructions to the participant before leaving the room:

Regardless of whether the event that you think of is similar to one or more of the examples I just gave you, we really want this to be about an experience that *you* have had. So, for the next minute, I would like for you to think about a time in your life when you felt this way and, when I return, I would like you to tell me about it.

The TCI

Following the 1-minute interview preparation period, the experimenter re-entered the room and asked the participant whether he or she was able to recall an event that matched the guidelines provided. All but one student could recall an event; the one cadet who could not was asked to choose one of the examples that had been read to him previously and to indicate which of those examples *would* make him feel the weakest or challenge his manhood or toughness the most, *if he were* to experience something similar in *his* life. The experimenter then repeated the aforementioned list of sample masculinity or toughness-challenging scenarios. Once the participant had chosen a situation for discussion, the experimenter said, "OK, now I would like you to tell me about a time in your life when you felt weak or like your manhood or toughness was challenged," and began audiotaping the interview. Our focus was to assure that the participant spoke for most if not all of the 3 minutes, and to standardize the interview in order to make it as similar as possible for all participants. Prompts included: (1) "How did (would) that situation make you *feel about yourself*?"; (2) "Tell me a little bit more about how that experience made (would make) you *feel*."; (3) "Tell me a little bit more about what you were (would be) *thinking* in that situation."; and (4) "Could you please describe, in a little more detail, *what happened* in that situation (what you think that situation would be like for you)?".

Self-report measures

Participants' self-ratings of self-esteem were measured using the Rosenberg (1965) Self-esteem Scale, a well-established and commonly used assessment tool. Peer-ratings were obtained using an adaptation of the Rosenberg scale.

Physiological recording

A BioZ impedance cardiograph and noninvasive blood pressure monitor (CardioDynamics, San Diego, CA) was used to record the electrocardiogram (ECG), blood pressure (mmHg), and impedance cardiographic data [necessary for calculating CO, TPR, and pre-ejection period (PEP)]. The BioZ records ECG and impedance data beat-by-beat, averages them over a pre-set number of heartbeats, and automatically computes HR (bpm), CO (L/min), TPR [peripheral resistance units (pru)], and PEP (msec; decreases reflect heightened myocardial contractility). For a brief discussion of the BioZ's hardware and software innovations and review of evidence of the resulting enhanced reliability and validity, see Kline, Fekete, and Sears (2008).

Blood pressure sampling schedule

During the initial rest period, blood pressure was obtained immediately and at the 2-minute and 4-minute marks. For the cold pressor test, readings were initiated immediately and at 1 minute into the stress period. The participants' blood pressure was taken at the beginning of the TCI preparation period, at the beginning of the TCI, and at 1 minute and 2 minutes into the interview. During the between-task and final rest periods, samples were obtained at the 1-, 3-, 5-, and 7-minute marks.

Data reduction

Data reduction for SBP, DBP, CO, TPR, HR, and PEP data consisted of computation of averages for rest periods, cold pressor, TCI preparation, and the TCI. The rest period data were averaged over the last two samples of each period. For purposes of data reduction and analysis, TCI preparation and the TCI were considered separate tasks. Cardiovascular stress-reactivity was defined in terms of change scores (difference between the mean stressor level and the mean resting baseline level).

Group Classification Procedure

Participants were divided into high and low self-rated self-esteem groups using a median split. Similarly, participants were also divided into high and low peer-rated self-esteem groups based on whether their scores were above or below the median. This procedure resulted in creation of four groups (see Table 1): true low self-esteem (low self-ratings, low peer-ratings), true high self-esteem (high self, high peer), unconscious repressors (high self, low peer), and defensive high self-esteem (i.e., conscious suppressors; low self, high peer).

Design and Analyses

A 2 (High, Low self-rated self-esteem group) x 2 (High, Low peer-rated self-esteem group) factorial design was used to examine group differences in cardiovascular reactivity to cold pressor, interview preparation, and interview. The primary analyses involved 2 x 2 analyses of covariance (ANCOVAs) using the covariate body mass index (BMI). An α level of .05 was used for all analyses.

Results

The ANCOVAs yielded significant main effects of self-rating group for SBP reactivity to interview preparation, $F(1, 14) = 16.26$, $p < .01$, interview, $F(1, 14) = 5.42$, $p < .05$, and cold pressor, $F(1, 13) = 16.73$, $p < .01$. In each case, low self-rating groups ($M_{TCI\ Prep} = 11.93$, $SD = 6.57$; $M_{TCI} = 17.93$, $SD = 5.44$; $M_{Cold} = 20.79$, $SD = 6.00$) had greater SBP than high self-rating groups ($M_{TCI\ Prep} = 2.96$, $SD = 4.43$; $M_{TCI} = 9.58$, $SD = 9.05$; $M_{Cold} = 12.09$, $SD = 5.41$). Similarly, there was also a significant main effect of self-rating group for DBP to interview preparation, $F(1, 14) = 6.31$, $p < .05$, with the low self-rating group ($M = 11.64$, $SD = 5.35$) once again showing greater responses than the high self-rating group ($M = 6.13$, $SD = 4.91$). There were also nonsignificant trends toward participants who rated themselves as low in self-esteem showing greater HR reactivity to interview preparation, $F(1, 14) = 4.39$, $p = .055$, and greater CO responses to the TCI, $F(1, 14) = 4.59$, $p = .050$. Analyses of CO reactivity to interview revealed a significant main effect of peer rating group, $F(1, 14) = 20.14$, $p < .01$. In contrast to the self-rating group results, the low peer-rating group exhibited lower CO responses to the TCI (See Figure 1). Similarly, analyses of interview PEP and cold pressor SBP revealed that the low peer-rating group ($M_{PEP\ TCI} = -1.25$, $SD = 6.36$; $M_{SBP\ Cold} = 13.00$, $SD = 5.68$) had lower responses than the high peer-rating group ($M_{PEP\ TCI} = -11.40$, $SD = 5.21$; $M_{SBP\ Cold} = 17.45$, $SD = 7.59$), $F(1, 14) = 9.62$, $p < .01$ and $F(1, 13) = 5.36$, $p < .05$, respectively. Conversely, results for TPR reactivity to the interview indicated higher responsivity for the low peer-rating group, $F(1, 14) = 4.96$, $p < .05$ (See Figure 2).

The main effect of self-rating group for interview preparation SBP was qualified by an interaction between self-rating group and peer-rating group, $F(1, 14) = 4.93$, $p < .05$. Follow-up tests indicated that defensive high self-esteem cadets had greater responses than true high self-esteem participants, $p < .05$ (See Figure 3).

Discussion

The present study found that cadets who rated themselves low in self-esteem had more of an increase in SBP, DBP, and HR to the interview preparation, and more of an increase in CO to the interview than those who rated themselves high in self-esteem. On the other hand, those whose peers rated them low in self-esteem showed lower CO and PEP reactivity to the interview, lower SBP responses to cold pressor, and a higher increase in TPR to the interview. Furthermore, cadets labeled as having defensive high self-esteem (high peer, low self) showed more of an increase in SBP to interview preparation than those cadets who had true high self-esteem (high peer, high self).

The findings in this current study provide further support for the view that self-esteem is multidimensional as described by Kernis (2003). Discrepancies between participants' self- and peer-ratings of self-esteem were observed, to include evidence of defensive high self-esteem.

Participants who had low peer-ratings in self-esteem exhibited higher vascular (i.e., TPR) and lower myocardial (i.e., CO, PEP) responses than those with high peer-ratings. When exposed to stressors that threatened their self-esteem, these low peer-rated participants demonstrated a pattern of cardiovascular response previously associated with "passive coping" or threat-related behavior (Kline, Saab, & Llabre, 2005; Obrist, 1981; Saab et al., 2007).

In contrast to the low peer-rating group, the low self-rating group exhibited a mixed response to the interview/interview preparation, due to an increase in HR and CO, a myocardial response, along with an increase in DBP, typical of a vascular response. Tomaka and Palacios-Esquivel (1997) found a mixed cardiovascular response pattern to be related to threat responses. These authors interpreted their findings as indicative of approach-avoidance conflict. With regard to our study, perhaps the participants rating themselves low in self-esteem experienced a conflict between wanting to comply with the task and/or "get something off their chest," while at the same time being apprehensive about going through with the task.

Davidson (1993) found that only suppressors showed the expected heightened SBP reactivity to an interpersonally stressful task, which supports our findings that defensive high self-esteem cadets (i.e., conscious suppressors of low self-esteem) also showed greater SBP reactivity to interview preparation than true high self-esteem participants. The structured interview used in Davidson's (1993) is similar to the interview preparation used in the current study, because they are both interpersonal tasks. Our results also uphold Davidson's (1993) hypothesis that a suppressed trait can have an impact on cardiovascular responses.

In contrast to cadets with defensive high self-esteem, those who were labeled as having true high self-esteem may have had a lower SBP response because they were not completely engaged in the task. This could have been due to the cadets being very comfortable with their self-esteem and, hence, unthreatened by the self-esteem salient task.

This study introduced a novel laboratory stressor, the TCI. Future work with the TCI is necessary in order to evaluate the extent to which it reliably elicits reactivity and to compare it with other stressors, particularly, alternative interview tasks.

One limitation of this study is the small sample size (19). In addition, the homogenous nature of the sample (predominantly Caucasian, male students at a military college) may restrict the generalizability of the findings.

While the Rosenberg (1965) Self-Esteem Scale has established reliability and validity, studies such as the current investigation call into question the scale's utility without simultaneous measurement of peer ratings. Future studies should use ratings from multiple peers in addition to self-ratings of self-esteem.

In light of recent evidence suggesting greater risk for cardiovascular diseases for individuals exhibiting vascular responses (Kapuku et al., 1999), the low peer-rating group in our study may be vulnerable. On the other hand, other researchers have suggested that even a mixed response can have negative health implications due to a myocardial response with a lack of compensatory decrease in vascular reactivity (Julius & Esler, 1975; Tomaka & Palacios-Esquivel, 1997). If this holds true, the low self-rating group may be susceptible as well. This low self-rating group included our defensive high self-esteem individuals and this mixed pattern appears to have driven an elevated SBP response.

In conclusion, the findings from our study indicate that the only participants not demonstrating

potentially maladaptive stress responses were those for whom there was agreement between high peer and self-ratings (i.e., true high or secure self-esteem). Given society's aforementioned obsession with self-esteem, at least from a physical health standpoint, the present findings suggest the need to ensure genuinely high self-esteem.

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Table 1

Group Classification

	Peer-ratings of Self-esteem	
Self-ratings of Self-esteem	Low Peer-rated Self-esteem	High Peer-rated Self-esteem
Low Self-rated Self-esteem	True Low Self-Esteem	Defensive High Self-Esteem (Conscious Suppressors)
High Self-rated Self-esteem	Unconscious Repressors	True High Self-esteem

Note. Participants were divided into four groups based on their peer and self-ratings of self-esteem (true low self-esteem = low self-ratings, low peer-ratings; true high self-esteem = high self, high peer; unconscious repressors = high self, low peer; and defensive high self-esteem or conscious suppressors = low self, high peer)

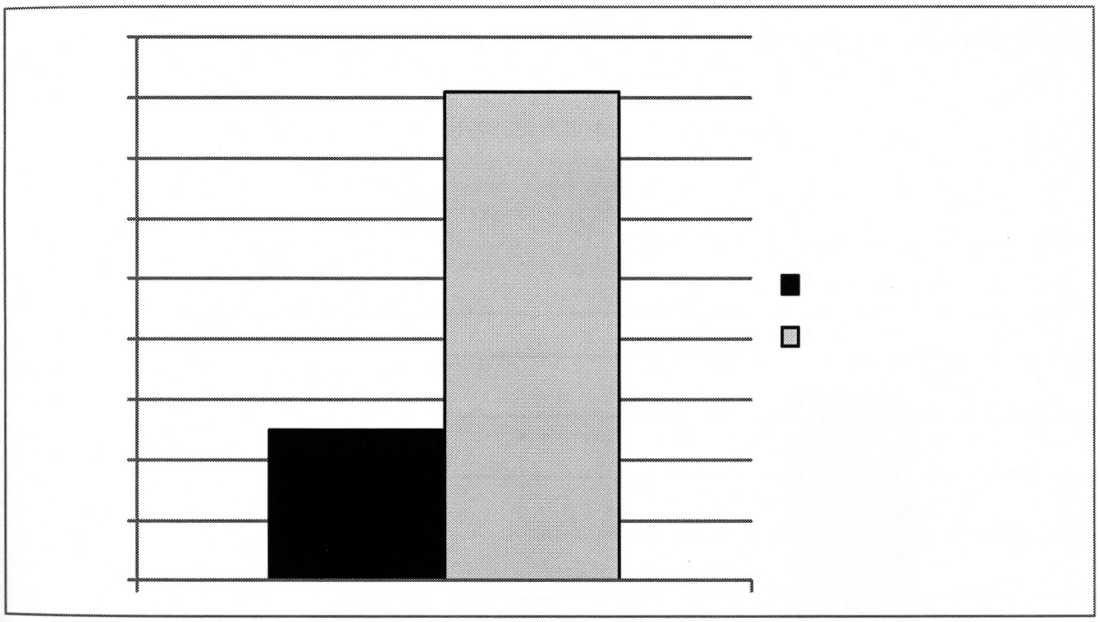

Figure 1. Mean change in cardiac output to the interview.

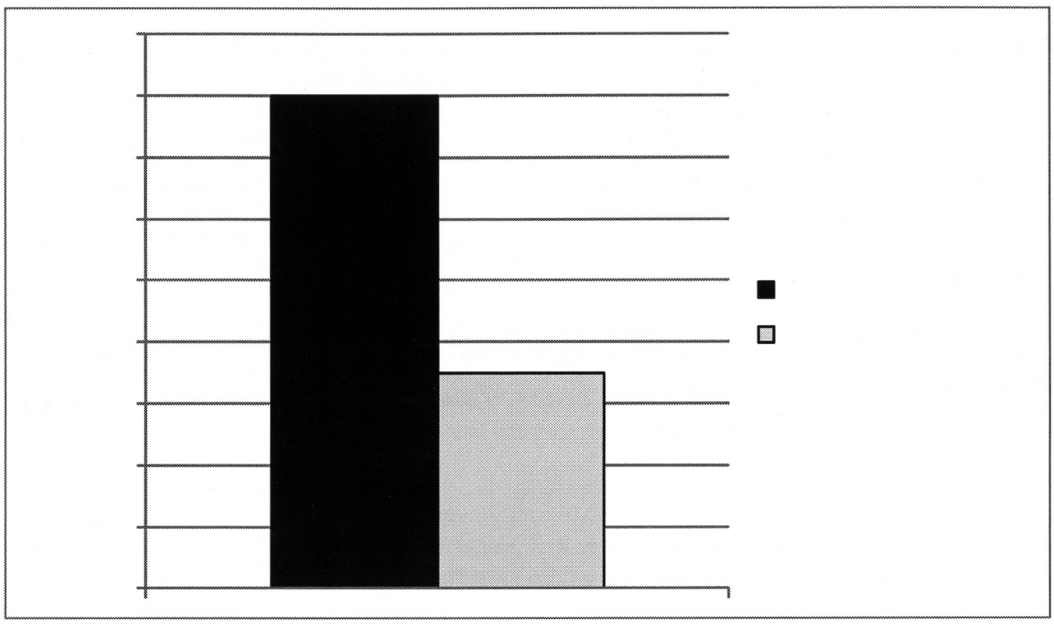

Figure 2. Mean change in total peripheral resistance to the interview.

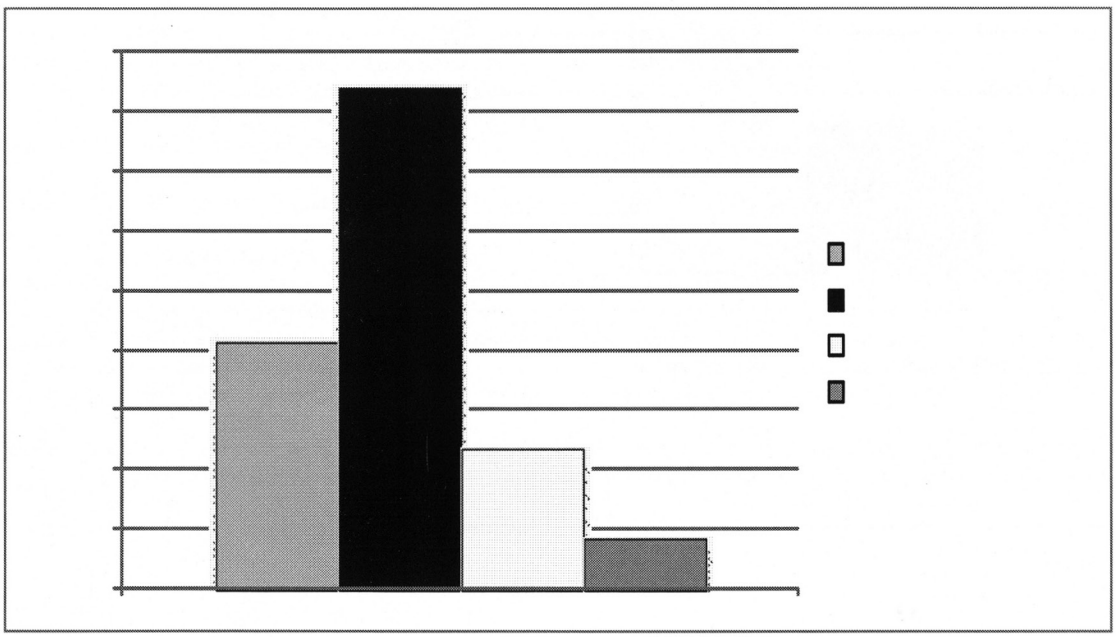

Figure 3. Mean change in systolic blood pressure to interview preparation.