Self-compassion as a predictor of interleukin-6 response to acute psychosocial stress

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ARTICLE INFO

ABSTRACT

We examined the hypothesis that self-compassion is associated with lower levels of stress-induced inflammation. On two consecutive days, plasma concentrations of interleukin-6 (IL-6) were assessed at baseline and at 30 and 120 min following exposure to a standardized laboratory stressor in a sample of 41 healthy young adults. Participants who were higher in self-compassion exhibited significantly lower day 1 IL-6 responses, even when controlling for self-esteem, depressive symptoms, demographic factors, and distress. Self-compassion was not related to day 2 IL-6 response but was inversely related to day 2 baseline IL-6 levels, and to increase in baseline IL-6 from day 1 to day 2. These findings suggest that self-compassion may serve as a protective factor against stress-induced inflammation and inflammation-related disease.

1. Introduction

Although modern humans are spared many of the physical stressors faced by our early ancestors, such as confrontations with predators, psychosocial forms of stress are pervasive in everyday life, from social exclusion to workplace tensions and marital conflict. When chronic, these forms of stress can be damaging to physical health. As one potential pathway, psychosocial stress has been shown to elicit an inflammatory cascade similar to that elicited by illness or injury (Segerstrom and Miller, 2004; Steptoe et al., 2007). This biological response is theorized to have evolved to promote healing and prevent infection in wounds resulting from physical conflict (Dhabar, 1998) and, some have suggested, to promote behavioral disengagement in dangerous situations (Kemeny et al., 2004). Although properly regulated inflammation is required and adaptive in certain contexts, elevated levels of inflammation can increase the risk of a range of diseases, including cardiovascular disease, cancer, and Alzheimer's disease (e.g., Danesh et al., 2008; Ershler and Keller, 2000).

According to social self preservation theory (Dickerson et al., 2004), psychosocial stress is especially likely to elicit increased peripheral inflammation, as well as other potentially maladaptive biological responses, when it involves threats to the self encountered in social evaluative contexts. A handful of studies provide support for the link between self-threat and inflammation. In one study, participants who performed a speech and math task in front of an evaluative audience showed increases in the production of tumor necrosis factor alpha (TNF-α) following the stressor, whereas those who performed the task alone did not show this response (Dickerson et al., 2009), suggesting that the presence of a socially evaluative audience was instrumental in eliciting an inflammatory response. A related study found that writing about a traumatic experience of self-blame, but not a neutral experience, led to increases in TNF-α receptor activity, especially among those participants reporting high levels of shame in response to the manipulation (Dickerson et al., 2004). Trait shame has also been linked cross-sectionally to higher baseline levels of the pro-inflammatory cytokine interleukin-6 (IL-6) as well as to lower glucocorticoid inhibition of IL-6 in vitro (Rohleder et al., 2008).

The present research examined the hypothesis that self-compassion, a self-attitude that involves treating oneself with kindness and nonjudgmental understanding (Neff, 2003a), may be associated with lower stress-induced increases in inflammation. Self-compassion may reduce the extent to which a stressor is experienced as self-threatening, thereby attenuating the magnitude and duration of the corresponding inflammatory response. In support of this idea, prior research found that a self-compassion intervention reduced feelings of shame and self-criticism (Gilbert and Procter, 2006) and that self-compassionate individuals were less emotionally reactive in stressful situations than those low in self-compassion (Leary et al., 2007). No prior research, however, has examined the relationship between self-compassion and inflammatory responses to stress.

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Previous research has shown that inflammation is influenced by psychological states that are related to but distinct from self-compassion. For example, a number of studies have linked positive mood to reduced inflammation (e.g., Brouwers et al., 2012; Sepah and Bower, 2009) and to healthy immune functioning more generally (for a review, see Marsland et al., 2007). In addition, mindfulness meditation, which involves non-evaluative attention to mental processes, has been shown to reduce stress-induced inflammation in both healthy and patient populations (e.g., Creswell et al., 2012; Rosenkranz et al., 2013). Meditation that focuses on increasing compassion for others has also been shown to reduce stress-inducted inflammation (Pace et al., 2009). Finally, recent research found that self-esteem was a protective factor against increases in interleukin-1 receptor antagonist (IL-1Ra) and TNF-α following acute psychosocial stress, but self-esteem was unrelated to IL-6 (O'Donnell et al., 2008).

Self-compassion is distinct from these related constructs in important ways. Although self-compassion may involve feelings of positive affect (i.e., compassion), these positive feelings are directed toward the self and toward the specific types of self-conscious emotions likely to arise in self-threatening situations, such as shame and humiliation (Dickerson et al., 2004). Self-compassion is also distinct from mindfulness. Whereas mindfulness involves non-judgmental observation of mental processes, self-compassion goes beyond non-judgment by involving the active expression of warmth and caring toward the self (Neff 2003a). Some research suggests that the development of self-compassion may in fact be a key mechanism explaining the effectiveness of mindfulness-based interventions (Baer, 2010).

Finally, although self-compassion and self-esteem are both directed toward the self, they are conceptually and empirically distinct. Unlike self-esteem, self-compassion is non-evaluative: people can have compassion for themselves even if they are not feeling good about themselves. Self-compassion has been shown to predict more balanced emotional reactions to laboratory-based stressors compared to self-esteem, including lower levels of negative affect and more realistic self-appraisals, potentially because self-compassion is less likely than self-esteem to promote defensive self-enhancement as a means of coping with self-threat (Leary et al., 2007). Research has also shown that self-compassion is associated with greater self-worth stability (Neff and Vonk, 2009), lower narcissism (Neff, 2003b), and greater self-improvement motivation (Breines and Chen, 2012) compared to self-esteem, making it a potentially more adaptive strategy for coping with threats to the self.

Recent research suggests that self-compassion may impact physical health through a number of pathways. For example, self-compassionate people may be more motivated to take care of their health by engaging in healthy lifestyle behaviors and adhering to medical regimens (Terry and Leary, 2011). Self-compassion may also affect health more directly by affecting the degree to which acute psychosocial stressors encountered in everyday life produce elevated levels of systemic inflammation that persist over time. In other words, self-compassion may operate through biological as well as health behavioral pathways.

The goal of the current research was to examine the relationship between self-compassion and inflammatory responses to a repeated laboratory-based psychosocial stressor. The use of a repeated stressor was intended to provide a window into the types of physiological responses participants might be likely to experience in daily life when psychosocial stressors were encountered. A standardized laboratory-based stressor, the Trier Social Stress Test (TSST; Kirschbaum et al., 1993), was used to hold constant the type and degree of stress and to allow for repeated blood sampling and assessment of interleukin-6 (IL-6), a pro-inflammatory cytokine that has been shown to be sensitive to stress and also to predict long-term health outcomes (Brydon and Steptoe, 2005; Steptoe et al., 2007). It was hypothesized that participants who were higher in trait self-compassion would show lower IL-6 responses to both an initial stressor and a similar stressor repeated on the following day.

Furthermore, it was hypothesized that the relationship between self-compassion and IL-6 response would be independent of self-esteem and depressive symptoms, which have been linked to both self-compassion and inflammation in prior research (Hiles et al., 2012; O'Donnell et al., 2008), and independent of demographic factors (i.e., age, gender, ethnicity), temporal factors (i.e., TSST start time), and body mass index (BMI). We also hypothesized that the relationship between self-compassion and inflammation would not be explained by differences in the extent to which the TSST was experienced as emotionally distressing.

2. Method

2.1. Participants

Data for this article were collected as part of a larger research project conducted over 2 years in which young adults (age 18–35) and older adults (age 50–65) were recruited. Participants were recruited from the Greater Boston area and the Brandeis University campus via newspaper, magazine, and facebook advertisements and received monetary compensation. In the current report we focused on the young adult participant group only ($N = 45$; Mean age = 21.17; SD = 3.91).

All participants underwent a brief medical and psychological screening by telephone before testing and were invited to participate only if they met a specific selection criteria: (a) body mass index (BMI) within the reference range between 18 and 30 kg/m^2; (b) luteal phase of menstrual cycle at time of participation, for females; (c) absence of psychiatric, endocrine, or cardiovascular diseases, or other specific chronic diseases; (d) no intake of psychoactive drugs, beta-blockers, gonadal steroids (hormonal contraceptives), GCs; (e) non-smoker, and (f) no previous experience with the stress protocol.

Four participants were excluded from analyses because their baseline IL-6 scores fell at least 3 standard deviations above the mean on the first study day ($n = 1$) or the second study day ($n = 3$). Two participants did not return on day 2 due to difficult blood draws, but they are still included in analyses conducted using data from the first study day.

Participants in the final sample ($N = 41$) were 44% female. Fifty-one percent of participants identified as White or Caucasian American, 34% as Asian or Asian American, 5% as Black or African American, and 10% as Other. BMI ranged from 19 to 30 kg/m^2 ($M = 24.26$, SD = 3.30).

2.2. Procedure

Eligible participants were scheduled for laboratory sessions on two consecutive days. All laboratory sessions were scheduled in the afternoon (1:30–6:30 pm) to control for circadian variation of stress hormones. Participants were instructed to refrain from eating or drinking anything but water for 1 h before the laboratory sessions. Written informed consent was obtained prior to participation and ethical approval was granted by the Brandeis University Institutional Review Board.

Each laboratory session lasted approximately three hours and included a resting period followed by exposure to the Trier Social Stress Test (TSST), and blood draws at baseline, 30, and 120 min following the TSST. At the beginning of day 1, self-compassion, self-esteem, depressive symptoms, and demographic factors were