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Trait positive affect and antibody response to hepatitis B vaccination

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Abstract

Recent evidence suggests that dispositional positive affect may be associated with decreased vulnerability to upper respiratory infections. To explore a potential pathway of this relationship, we examined whether trait positive affect is related to an in vivo immune response relevant for host resistance to infection. Eighty-four healthy, graduate students who tested negative for prior expose to the hepatitis B virus were administered the standard hepatitis B vaccination series. Five months after the first dose, a blood sample was collected for the measurement of specific antibody response to the vaccine and subjects completed a battery of psychosocial questionnaires. Higher scores on a measure of dispositional positive affect were associated with a greater antibody response to hepatitis B vaccination. This relationship occurred after controlling for demographics and body mass and was largely independent of concomitant levels of dispositional negative affect, optimism, and extraversion. In the presence of dispositional positive affect, there was no independent effect of trait negative affect on antibody response. Physical activity played a protective role for individuals low in positive affect, being related to higher antibody responses. These data provide initial evidence that individual differences in dispositional positive affect may be of health significance, being related to an in vivo immune response relevant for protection against infection.

Keywords: Psychoneuroimmunology; Positive affect; Emotion; Hepatitis B vaccine; Vaccination response; Optimism; Extraversion; Physical activity

1. Introduction

In support of popular belief, recent findings suggest that individuals who characterize themselves by moods such as happy, pleased, relaxed, and lively are less vulnerable to upper respiratory infections (Cohen et al., 2003). These findings add to a developing literature suggesting that dispositional positive affect may play a role in health improvement (Pressman and Cohen, in press). In their study, Cohen and colleagues experimentally inoculated 334 healthy, adult volunteers with common cold viruses and then quarantined and monitored them for the development of biologically verified upper respiratory infections. Findings demonstrated a dose–response relationship between higher positive emotional styles measured before the inoculation and lower risk of developing a cold. In contrast, there was no relationship between negative emotional styles and colds. A large number of control factors (including age, sex, education, negative affect, and virus-specific antibody status before challenge) were not able to explain decreased risk for colds among persons reporting higher dispositional PA.

A number of potential pathways exist through which an association between PA and infectious disease susceptibility might occur, including behavioral and immune mechanisms. A positive emotional style could promote health through health-enhancing behaviors (Myers and Diener, 1995). For example, better sleep quality and more exercise have been associated with high PA (Bardwell et al., 1999; Cohen et al., 2003), better immune function (Kiecolt-Glaser and Glaser, 1988) and decreased susceptibility to the common cold (Cohen et al., 1997). Another pathway through which emotions could influence infectious pathology is via

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modulation of immune function, influencing host susceptibility to infectious pathogens. Here, there is extensive evidence for direct anatomical and functional links between the central nervous and immune systems, providing a biological pathway for the influences of emotions on response to viral pathogens (Rabin, 1999). However, in contrast to a large literature examining the relationship between negative emotions and compromised immune function (Kiecolt-Glaser et al., 1992; Sergerstrom and Miller, 2004), only a few studies have examined immune function that accompanies PA. Initial findings suggest immune benefits of daily fluctuation in positive mood, including increased antigen-specific secretory immunoglobulin A response to an ingested innocuous protein (Stone et al., 1987) and increased natural killer cell cytotoxicity (Valdimarsdottir and Bovberg, 1997). To date, immune changes that accompany more enduring PA remain unknown. It is likely that dispositional (trait) PA would be associated with larger and more stable immune differences that would alter the ability of the body to resist viral infections.

The goal of the following study is to further explore the relationship between trait levels of PA and infectious disease susceptibility, by examining whether trait positive emotional style is associated with antibody response to hepatitis B vaccination. We define PA as the feelings that reflect a level of pleasurable engagement with the environment (Clark et al., 1989). We have previously reported that trait negative affect is associated with a reduction in antibody response to this vaccine (Marsland et al., 2001). Recent interest in the influence of PA on health and findings suggesting decreased disease risk among persons with a positive emotional style (Pressman and Cohen, in press), led us to examine whether trait PA is associated with antibody response and, if so, whether this relationship is independent of trait NA.

While there is much current debate regarding the structure of affect (e.g., Izard, 1977; Larsen and Diener, 1992; Watson and Tellegen, 1985), there is a growing consensus that positive and negative affect are broad, underlying dimensions of basic emotions that consistently emerge across studies (Watson and Tellegen, 1985). However, the relationship between them remains unclear. Rather than being opposite extremes of the same underlying construct, trait measures of emotional style are thought to be mutually independent, with PA conferring health benefits independently of NA levels (Cohen et al., 2003; Diener and Emmons, 1985). Recent evidence demonstrates that positive and negative affective styles are associated with asymmetrical activation of regions of the prefrontal cortex in the brain (Davidson et al., 1999). Individuals who show high levels of left-sided prefrontal activation endorse higher levels of dispositional positive affect and also show improved immune function, as measured by increased natural killer cell activity, when compared with their right-frontally activated counterparts who endorse more dispositional negative affect (Davidson et al., 1999, 2000). Consequently, we expected that PA would be associated with better antibody response, even after controlling for the influences of NA.

Another issue that requires clarification in the literature linking PA to health is the role of psychological concepts that are closely related to PA, such as optimism and extraversion. These factors have been related to improved objective health outcomes (e.g., Cohen et al., 1997; Scheier and Carver, 1987) and to improved immune function (Miller et al., 1999; Sergerstrom et al., 1998). Furthermore, extraversion has been associated with decreased susceptibility to upper respiratory infections (Broadbent et al., 1984; Cohen et al., 1997; Totman et al., 1980). Thus, it is possible that these dispositional characteristics account for associations between PA and infectious disease susceptibility. In this study, we controlled for these third factors and explored the independent contributions of optimism, extraversion and trait PA to antibody response. Finally the possibility that health practices, including smoking, alcohol use, and physical activity mediate the relationship between trait PA and antibody response was explored.

For this study, we chose to examine the influence of affective style on secondary immune response to a novel antigen, hepatitis B vaccination. This decision was based on an existing literature suggesting that trait affect has its greatest impact on secondary as opposed to primary immune response to vaccination (as reviewed by Cohen et al., 2001). In the case of antibody response to hepatitis B vaccine series, this phase occurs after the second vaccination, a period when it has been demonstrated that psychosocial factors are associated with magnitude of antibody response (e.g., Jabaai et al., 1993; Marsland et al., 2001). A second reason to focus on antibody responses to the second vaccination in this 3 dose sequence is the typical titer response to each of the vaccinations. There is little variability in response across individuals following either the first vaccination, when only about 25% of individuals have discernable levels of antibody, or the third vaccination, when the majority of recipients have mounted maximal antibody responses. In contrast, there is widespread interindividual variability in the magnitude of antibody response following the second vaccination (Szmuness et al., 1980). At this timepoint, the majority of individuals have mounted an antibody response; however, the range of antibody responses is widely dispersed, enabling us to explore emotional factors associated with individual difference in response.

2. Method

2.1. Participants

The participants were 51 male and 33 female graduate students ages 21–33 years (mean = 24) who volunteered to participate in a study investigating whether psychological factors influence immune response to hepatitis B vaccination. Three participants were dropped from data analyses due to problems collecting blood samples, leaving a final sample of 81. All subjects were of normal weight, healthy, endorsed no history or symptoms of systemic diseases known to affect the immune system and were native English