



THE RELATIONSHIP BETWEEN EMOTIONAL RUMINATION AND CORTISOL SECRETION UNDER STRESS

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Summary—This study investigated the relationship between emotional rumination and cortisol secretion during stress. Subjects were 51 student nurses undergoing a written examination as part of their training and urinary-free cortisol was assayed from samples taken immediately after the examination and again three weeks later. Cortisol difference scores were obtained, expressed as a function of creatinine, assayed simultaneously, and baseline cortisol levels. Subjects completed the Eysenck Personality Inventory (EPI) and the Emotion Control Questionnaire (ECQ) and results showed that cortisol differences were associated with the rehearsal (or rumination) scale from the ECQ and to a lesser extent ECQ emotional inhibition and EPI neuroticism. © 1998 Elsevier Science Ltd. All rights reserved

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INTRODUCTION

The deleterious effects of stress on health have been widely reported, but questions remain about the mechanisms which might be involved in linking the cognitive process of perceived threat with physical illness. Psychoimmunological research has suggested that a plausible candidate mechanism is sustained activation of the hypothalamic-pituitary-adrenal axis (Jemmott & Locke, 1984) and there is ample evidence for the role of adrenocortical and adrenomedullary systems in regulating cardiac activity and immune function (Asterita, 1985; Cacioppo, 1994). However, wide individual differences in cognitive and physiological responses to stress suggest that physiological mechanisms are influenced by moderator variables. Personality has been proposed as one of these moderators, and the early work of Kobasa (1979) on “hardiness” did indeed suggest that having an internal locus of control may buffer individuals against the impact of stressful life events.

Unfortunately, Denney and Frisch (1981) failed to support the hypothesised moderating effect of locus of control on stress and other work has shown that having an internal locus of control may confer a greater susceptibility to stress amongst subjects who experience high levels of uncontrollable events (Meadows, 1989). Other personality factors which have been investigated in the context of stress include extraversion and neuroticism, but the findings here have also been equivocal. For example, while Totman *et al.* (1980) and Broadbent *et al.* (1984) reported higher levels of susceptibility to experimentally-induced colds amongst introverts as compared to extraverts, the effect was not replicated in a more carefully controlled study by Cohen *et al.* (1993). The latter authors included a measure of locus of control in their study and again they found no moderating effects for perceived control on induced infection.

Reviewing these findings, Roger (1995) has argued that the personality constructs used in earlier studies had not been developed specifically in the context of stress research and were therefore inappropriate. Roger and his colleagues have suggested an alternative model based on emotional inhibition and rumination, and the Emotion Control Questionnaire (ECQ; Roger & Nesseshoever, 1987; Roger & Najarian, 1989) was developed to assess these tendencies. Validation studies of the ECQ have shown that scores on the rehearsal (or rumination) scale from the ECQ are significantly related to delayed heart-rate recovery following stress (Roger & Jamieson, 1988), which can be explained by sustained activation of the adrenomedullary system through cognitive rumination.

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The role of emotional inhibition in prolonging physiological activation has also been demonstrated by independent studies of delayed muscle tension recovery following stress (Kaiser *et al.*, 1995).

Elevations in cortisol levels offer a reliable index of stress (Lundberg & Frankenhaeuser, 1980; Leedy & Wilson, 1985; Kirschbaum *et al.*, 1992) and relating cortisol secretion to arousal and personality, Dabbs and Hopper (1990) demonstrated that subjects with high levels of cortisol had higher blood pressure and tended to be more anxious than those with low cortisol levels. The effect sizes in the Dabbs and Hopper paper were not large, but the study focused on resting levels of physiological activity and did not involve a systematic manipulation of stress. In addition, the personality scales used by these authors were the NEO-PI (Costa & McCrae, 1985) and the MMPI (Dahlstrom *et al.*, 1972), which were designed as global indices of individual differences and were not developed specifically in the context of stress research.

The present paper reports on the effects of personality variables on cortisol secretion following exposure to stress. The scales used were the Eysenck Personality Inventory (Eysenck and Eysenck, 1964), which was chosen in preference to the more recent Eysenck Personality Questionnaire (EPQ; Eysenck & Eysenck, 1975), and the ECQ. The reasons for using the EPI were primarily psychometric and are discussed in the Method section. In view of the earlier work on heart-rate recovery (Roger & Jamieson, 1988), the rehearsal index of emotional rumination from the ECQ was expected to be particularly strongly associated with levels of urinary-free cortisol following exposure to a naturalistic stressor.

METHOD

Subjects

Subjects were 74 student nurses, all of whom were undergoing training at the School of Nursing attached to the district hospital in York, U.K. The experiment involved a follow-up and the data for 15 subjects were incomplete owing to absence from the second testing session. A further five subjects were omitted owing to reported illness or negative events over the period of the study (see Procedure) and samples for three subjects were lost during assay. Complete returns were available for a sample of 51 subjects ($M = 22.37$ years; $SD = 3.87$; $r = 18-42$ years). Only four subjects were male and the data for males and females were therefore pooled for the analyses.

Procedure

All subjects completed two personality questionnaires at the start of the study: the Emotion Control Questionnaire (ECQ; Roger & Neshoever, 1987; Roger & Najarian, 1989) and the Eysenck Personality Inventory (EPI; Eysenck & Eysenck, 1964). The ECQ comprises four scales, labelled rehearsal, emotional inhibition, aggression control and benign control. Rehearsal measures the degree of rumination over emotionally upsetting events, and as the title implies, the second scale assesses the tendency to inhibit or "bottle up" experienced emotion. Scores on aggression control reflect the inhibition of hostility independently of the more general emotional restraint measured by emotional inhibition and is generally orthogonal to both rehearsal and emotional inhibition.

The fourth scale was dubbed "benign control" to distinguish it from aggression control and it correlates substantially with indices of impulsiveness (Roger & Neshoever, 1987). Aggression control and benign control tend to correlate positively and the two scales appear to form part of the extraversion constellation. All four ECQ scales comprise 14 items each and the mean scores for the sample in this study were 5.00 ($SD = 2.94$) for emotional inhibition, 5.54 ($SD = 3.83$) for rehearsal, 6.67 ($SD = 2.85$) for aggression control and 6.87 ($SD = 2.23$) for benign control. These means differ slightly from those obtained from samples of university students (Roger & Najarian, 1989), but are nonetheless broadly comparable.

The EPI includes scales for extraversion and neuroticism in addition to a lie scale and was chosen in preference to the more recent Eysenck Personality Questionnaire (EPQ; Eysenck & Eysenck, 1975) because of the psychometric differences between them. For example, EPI extraversion breaks down reliably into impulsiveness and sociability, whereas EPQ extraversion is exclusively sociability, the impulsiveness items having migrated onto the new psychoticism scale (Rocklin & Revelle, 1981; Roger & Morris, 1991). Sub-scales for hypochondriasis and social sensitivity can be distinguished

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