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Prolactin in response to acute psychosocial stress in healthy men and women

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KEYWORDS

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Summary

Background: Serum levels of the anterior pituitary hormone prolactin have been reported to increase in response to different types of psychological stressors in humans. However, experimental laboratory stress studies investigating the acute response of prolactin to psychological stress show inconsistent results as increased, as well as decreased or unchanged levels of prolactin have been reported.

Objective: The aim of this study was to investigate the effect of acute psychosocial stress on serum concentrations of prolactin in healthy men and women and possible sex differences.

Method: Thirty men and 15 women (age 30–50 years) underwent Trier Social Stress Test (TSST), a tool for investigating psychobiological stress responses in a laboratory setting. Blood samples were collected before and directly after the stress test and after 30 min of recovery.

Results: We observed significantly elevated prolactin levels – along with significantly increased plasma adrenocorticotrophic hormone (ACTH), serum cortisol, heart rate, systolic blood pressure (SBP), and diastolic blood pressure (DBP) – in response to the stressor. The prolactin response pattern did not differ between men and women, but there was some indication that women might have higher magnitude of response. Large individual differences regarding the magnitude of response were seen in general. The magnitude of the prolactin response was significantly related to the magnitude of the response of the hypothalamic–pituitary–adrenal (HPA) axis and, to some extent, the cardiovascular responses, indicating that individual differences in prolactin response in healthy men and women are dependent on the general physiological stress activation. In women, the magnitude of response was also related to estradiol level.

Conclusion: Prolactin does increase in response to psychosocial stress, however, with large individual variation in magnitude of response. The pattern of prolactin response does not differ between men and women. However, there was some indication that women might have higher magnitude of increase than men, and that the magnitude of response in women was dependent on estradiol levels, and this needs to be further studied.

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1. Introduction

Prolactin is a peptide hormone mainly synthesized and secreted by lactotrope cells in the anterior pituitary gland. The secretion is primarily regulated by dopamine neurons, which have an inhibitory effect. Prolactin was discovered over 80 years ago and was given its name because of its ability to promote lactation in response to the suckling stimulus of the baby. Now it is known that prolactin is a multifunctional hormone, with over 300 biological activities including functions in reproduction, homeostasis, and the immune system (Freeman et al., 2000). Prolactin has been reported to increase in response to different types of psychological stressors in humans (Schedlowski et al., 1992; Theorell, 1992; Theorell et al., 1993; Grossi et al., 1999; Sonino et al., 2004; Uhart et al., 2006). The physiological importance of stress-induced prolactin increase is not clear, but prolactin has been suggested to have a protective role against the damage caused by stress (Drago et al., 1989; Dorshkind and Horseman, 2001), possibly through immunohancement (Black, 1994; Fomicheva et al., 2004) and to be a regulator of the stress response (Torner et al., 2001). Prolactin is thus considered to be a stress hormone. However, experimental laboratory stress studies investigating the acute response of prolactin to psychological stress show inconsistent results. Increased (Meyerhoff et al., 1988; Kirschbaum et al., 1993; Uhart et al., 2006; Chong et al., 2008) as well as decreased (Gerra et al., 2000, 2001; Atanackovic et al., 2002; Heesen et al., 2002; Rouach et al., 2007) or unchanged (Gerra et al., 2000; Munro et al., 2005) prolactin levels in response to psychosocial stress have been reported. Studies on acute psychosocial stress and prolactin have been predominantly conducted on men; thus, knowledge about prolactin response in women is more limited. The aim of this study was to investigate the effect of acute psychosocial stress on serum concentrations of prolactin in healthy men and women, and possible sex differences, by using the Trier Social Stress Test (TSST), a well-established tool for investigating psychobiological stress responses in a laboratory setting.

2. Methods

2.1. Participants

Forty-five healthy subjects (30 men and 15 women), aged 30–50 years (mean age 39 years, SD 5.7 years), were included in the study. The subjects were recruited from a cohort study, surveying psychosocial work environment and health, and through advertising in a local daily newspaper. To be included in the study, subjects had to be between 30 and 50 years of age, and only individuals reporting “no stress at all” or “very little stress” on a single perceived stress item (Elo et al., 2003) were included in order to avoid inclusion of individuals suffering from chronic stress problems. Exclusion criteria were; having a body mass index less than 18.5 kg/m² or over 30 kg/m², high blood pressure, infection, vitamin B-deficiency (high homocysteine), known systemic disease such as diabetes or thyroid disease or known psychiatric disease. As the menstrual cycle and the use of estrogens are known to affect the physiological response to acute stress (Kirschbaum et al., 1999; Kajantie and Phillips, 2006), women taking estrogens and postmenopausal women were excluded.

Subjects who were taking psychoactive medications or any medications that may affect the HPA axis function were excluded. Other exclusion criteria were being pregnant or nursing. Initially, by using information on age, BMI, perceived stress level and use of medication, 235 individuals were selected from a cohort of 3600 participants and asked to participate in the study. Of those 235 individuals, 103 never replied, 25 declined, and remaining 107 reported interests in participate in the study. Fifteen of these 107 individuals reported in the answering letter that they use medication, were pregnant or were nursing. 92 individuals were called for screening (24 men and 68 women). 64 of these regret the decision to participate in the study or failed to come (19 men and 45 women). 28 individuals came to screening (5 men and 23 women). Additional participants were recruited by advertising in the daily local newspaper. Interested individuals e-mailed or called to the research nurse. Pre-screening was done, asking about medication, BMI, age, pregnancy and nursing. 57 individuals were called to screening (44 men and 13 women). 7 of these regret the decision to participate or failed to come (4 men and 3 women). 49 individuals came to screening (40 men and 9 women). Thus, in total 77 individuals were called to the screening procedure, which included blood samples and questionnaires to ensure that exclusion criteria were not fulfilled. Of the 28 individuals recruited to come to screening through the cohort, 14 were excluded according to the exclusion criteria (3 men and 11 women) and 14 were participating in the study (2 men and 12 women). Of the 49 individuals recruited to come to the screening through advertising, 7 individuals regret the decision to participate (6 men and 1 woman), 7 individuals were excluded (6 men and 1 woman) according to the exclusion criteria and 35 participated in the study (28 men and 7 women). The study was approved by the Regional Ethical Review Board in Göteborg, Sweden, and was conducted according to the Helsinki Declaration. All participants gave written informed consent before entering the study. For female subjects, the stress tests were conducted during the 5–10 day of the menstrual cycle (self-reported follicular phase). Menstrual cycle phase was then validated by measuring serum levels of estradiol and progesterone in samples collected before the stress test. The results confirmed that 15 of the 19 females were really tested in the follicular phase while 4 of the females were not. These four women were excluded from the analysis.

2.2. Study procedure

The participants underwent the TSST, a well-known standardized laboratory stress test. The TSST was set up according to the original design of Kirschbaum et al. (1993). The stress task in TSST consists of a simulated job interview and a mental arithmetic task, both in front of a committee (two men and one woman), a video camera, and a microphone. Subjects were instructed to abstain from hard physical exercise 24 h before the stress test. Subjects were also instructed to avoid beverages containing caffeine at least 2 h before the stress test and to eat a standardized lunch. Smoking and using snuff were accepted but not on the test day. The stress tests were performed at the Institute of Stress Medicine of Region Västtra Götaland in Göteborg. The total test time for each subject was 2 h, including preparations and measurements

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