



SHORT COMMUNICATION

Positive life events predict salivary cortisol in pregnant women

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Abstract Maternal stress during pregnancy has been repeatedly associated with problematic child development. According to the fetal programming hypothesis adverse experiences during pregnancy increase maternal cortisol, which is then assumed to exert a negative effect on fetal development. Recent studies in non-pregnant women report significant associations between positive emotionality and low cortisol levels. We tested in a sample of 60 pregnant women whether both negative and positive life events independently predicted third-trimester baseline awakening cortisol levels. While the effect of negative life events proved unrelated positive life events significantly predicted lower cortisol levels. These findings suggest that positive experiences are of relevance regarding maternal morning cortisol levels in pregnancy reflecting a resource with potentially beneficial effects for the mother and the developing fetus. It might be promising for psychological intervention programs to focus on increasing positive experiences of the expecting mother rather than exclusively trying to reduce maternal stress during pregnancy.

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1. Introduction

An extensive number of both human and animal studies suggests that experiences during the prenatal period influence fetal development (for review see, e.g. Talge et al., 2007). Most of these studies focus on the negative effects of

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maternal stress during pregnancy on problematic outcomes in offspring. According to the prevailing hypothesis elevated levels of maternal cortisol, in response to prenatal stress, produce permanent alterations of the hypothalamic–pituitary–adrenal (HPA) axis of the developing fetus (Weinstock, 2008). Studies that also consider potentially protective effects of psychosocial resources on fetal development in the face of maternal stress during pregnancy are sparse. Further, human studies rely primarily on subjective reports of psychological stress (e.g., self-reported anxiety) that tend to be substantially confounded with inheritable maternal personality traits (for example neuroticism, see Pluess et al., 2010). Some studies, however, also include more objective measures of stress like exposure to distinct negative life events. While many of these studies chronicle associations between negative life events during pregnancy and maladaptive child outcomes, the link between adverse events and elevated maternal cortisol in pregnancy—one of the hypothesized mechanisms of fetal programming—has been more difficult to demonstrate (e.g., Wadhwa et al., 1996).

Recently, in the wake of the emerging field of positive psychology (Seligman and Csikszentmihalyi, 2000), several studies investigated associations between positive emotionality and cortisol in non-pregnant samples. For example, Steptoe et al. (2005) found a significant association between self-reported happiness and diurnal cortisol levels in a sample of 227 adult men and women with the most happy study participants exhibiting the lowest cortisol levels across the day. Similarly, Polk et al. (2005) reported significantly lower morning cortisol in healthy women characterized by high positive state affect. More recently, these findings have been extended to the study of cortisol reactivity involving a sample of 40 healthy women (Bostock et al., 2011). Women characterized with high positive emotionality had significantly lower cortisol release in response to a stressful task.

Studies investigating mechanisms of fetal programming have been focusing almost exclusively on heightened maternal cortisol levels in response to adverse experiences during pregnancy with hitherto inconsistent results in human studies. In light of recent findings reporting associations between positive emotionality and both lower diurnal cortisol levels and decreased cortisol reactivity in non-pregnant healthy women, the inclusion of positive experiences and the investigation of their effect on maternal cortisol during pregnancy may represent an important addition to research exploring mechanisms underlying fetal programming.

In the current longitudinal study we tested whether baseline awakening cortisol levels in pregnant women in the last trimester of pregnancy are predicted by both negative and positive life events which occurred within the 12 preceding months, reported retrospectively at the end of the first trimester. Given a previous analysis of the same study chronicling significant associations between psychological and biological stress measures and maternal neuroticism we controlled for maternal neuroticism (Pluess et al., 2010). Based on theory and existing research we hypothesized that negative life events would predict higher and positive life events lower maternal morning cortisol levels.

2. Method

2.1. Overview

The present work is based on data from a prospective longitudinal study on the effects of prenatal maternal stress on early postnatal infant development employing several assessment points during pregnancy and the early postpartum period (Wurmser et al., 2006). The present study includes only data collected during the prenatal period. Subject recruitment and data collection took place in Trier, Germany.

2.2. Sample and procedure

Participants were recruited in collaboration with local obstetricians/gynecologists in private practice, clinic departments of gynecology and obstetrics, information centers for pregnant women, and by advertisements in local newspapers. Women that met inclusion criteria (age of 16 years or older and fluency in German) were contacted by phone and briefly informed about the study's research protocol. Exclusion criteria were: (a) severe medical complications, (b) signs of fetal malformation, (c) multi-fetal pregnancies, and (d) self-reported psychiatric problems. After providing informed consent for participation eligible women were invited for a first assessment at 10–20 weeks gestation and a second assessment at 32–34 weeks gestation.

Originally, a total of 94 women were recruited into the project but due to attrition and missing data only 60 (63.8%) women were available for the present analysis. Comparisons between the selected sample of 60 and the 34 excluded women indicated no significant differences between the two groups on any demographic, biological, or psychological variables (see Table 1 for sample characteristics).

All women were paid 200 Euro for their time and efforts in participating in the project. The study protocol was approved by the research ethics committee of the University of Trier and is consistent with the revised Helsinki Declaration of 1975.

2.3. Measures

2.3.1. Demographic and psychological variables

Structured interviews were conducted by trained female research assistants at enrollment into the study and inquired about socio-demographic (e.g., age, education, occupation, income, and marital status) and medical information. Life events were measured using a German version of the Life Experiences Survey (LES; Sarason et al., 1978), which lists 47 events that require adjustment (e.g., marriage, change of job, relocation, and death of a family member). Subjects were asked to indicate whether the listed life events occurred during the preceding 12 months and if so, to rate the impact on a seven-point scale ranging from "1 = extremely negative" to "7 = extremely positive". Summing up the occurrences with negative impact ratings (i.e., 1–3) yielded a measure for the number of negative life events and summing up the occurrences with positive impact ratings (i.e., 5–7) a measure for the number of positive life events the participants experienced. The LES was administered in early pregnancy (10–20 weeks gestation). Neuroticism was

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