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Effects of relaxation on psychobiological wellbeing during pregnancy: A randomized controlled trial

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Summary Prenatal maternal stress is associated with adverse birth outcomes and may be reduced by relaxation exercises. The aim of the present study was to compare the immediate effects of two active and one passive 10-min relaxation technique on perceived and physiological indicators of relaxation.

39 healthy pregnant women recruited at the outpatient department of the University Women's Hospital Basel participated in a randomized controlled trial with an experimental repeated measure design. Participants were assigned to one of two active relaxation techniques, progressive muscle relaxation (PMR) or guided imagery (GI), or a passive relaxation control condition. Self-reported relaxation on a visual analogue scale (VAS) and state anxiety (STAI-S), endocrine parameters indicating hypothalamic-pituitary—adrenal (HPA) axis (cortisol and ACTH) and sympathetic-adrenal-medullary (SAM) system activity (norepinephrine and epinephrine), as well as cardiovascular responses (heart rate, systolic and diastolic blood pressure) were measured at four time points before and after the relaxation exercise.

Between group differences showed, that compared to the PMR and control conditions, GI was significantly more effective in enhancing levels of relaxation and together with PMR, GI was associated with a significant decrease in heart rate. Within the groups, passive as well as active relaxation procedures were associated with a decline in endocrine measures except epinephrine.

Taken together, these data indicate that different types of relaxation had differential effects on various psychological and biological stress systems. GI was especially effective in inducing self-reported relaxation in pregnant women while at the same time reducing cardiovascular activity.

1. Introduction

Prenatal maternal stress is associated with several adverse consequences like enhanced risk for preterm delivery, foetal growth restriction, and low birth weight (Alder et al., 2007;

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Diego et al., 2006; Field et al., 2004; Lopez Bernal, 2007; Makrigiannakis et al., 2007). Moreover, some studies have shown an association of maternal stress and anxiety with increased arterial blood pressure as well as decreased uterine blood flow (Field et al., 2006a; Glover, 1999; Sjöström et al., 1997; Teixeira et al., 1999). Pregnancy-related health problems like preeclampsia or pregnancy-induced hypertension are associated with elevated maternal stress hormone levels (Hernandez-Valencia et al., 2007; Laatikainen et al., 1991). In addition to these longitudinal studies, experimental research has shown that foetuses show physiological reactivity when their mothers are exposed to a stressor (DiPietro et al., 2003; Fink et al., 2009), which is more pronounced in women with high levels of mental health problems (Monk et al., 2000, 2003, 2004).

Enhanced levels of stress, anxiety and depressed mood have been found in pregnancy to be associated with altered physiological parameters. For example, when experiencing stress or mental health problems, pregnant women's peripheral physiology is characterized by an up-regulated activity of the hypothalamic-pituitary—adrenal (HPA) axis (de Weerth and Buitelaar, 2005; Obel et al., 2005). The HPA is one of the primary stress systems in humans and regulates the release of glucocorticoids such as cortisol (Johnson et al., 1992), whereas the sympathetic-adrenal-medullary (SAM) system, a second important regulator of human stress reactivity, releases the catecholamines norepinephrine (NE) and epinephrine (E). During pregnancy, catecholamine levels have been found to be elevated in women with occupational stress (Katz et al., 1991). Assessment of E and NE is relatively uncommon during pregnancy since they need to be measured in blood plasma and have half-lives of only about 2 min in circulation (Ganong, 2001). Indirectly, SAM activity can be assessed by measuring blood pressure and heart rate changes (de Weerth and Buitelaar, 2005).

How these altered physiological processes in pregnant women contribute to adverse pregnancy outcomes is not well understood. Moreover, although research points at the connection between stress in pregnancy and course of pregnancy, foetal development and birth outcomes, there is little knowledge about the benefit of specific interventions for pregnant women to reduce stress. Relaxation techniques such as pleasant guided imagery (GI) (Daake and Gueldner, 1989), or progressive muscle relaxation (PMR) (Jacobson, 1938), have been proven to be reliable methods in reducing self-reported stress and stress-related physiological activity in various non-pregnant clinical populations, as well as in healthy subjects (e.g., Cruess et al., 2000a,b; Field et al., 1996; Pawlow and Jones, 2002, 2005; Rider et al., 1985; Tsai and Crockett, 1993; Watanabe et al., 2006). Furthermore, it has been demonstrated that brief psychological interventions with GI and PMR are appreciated by patients undergoing elective resection of colorectal cancer after surgery and have been recommended for implementation in these patients (Haase et al., 2005).

Studies on the impact of relaxation during pregnancy reveal various notable effects (e.g., Beddoe and Lee, 2008 for review). First of all, when exercising regularly, relaxation techniques contribute to a reduction in preterm delivery, longer gestation, increase in birth weight, reduction in caesarean section, and reduction in instrumental extraction (Bastani et al., 2005, 2006; Field et al., 2004, 1999; Nickel et al., 2006; Teixeira et al., 2005; Urizar et al., 2004). The immediate impact of relaxation on pregnant women indicates a reduction in experienced stress or anxiety (Bastani et al., 2005, 2006; Field et al., 2004, 1999; Nickel et al., 2006; Teixeira et al., 2005; Urizar et al., 2004). Further, decreased HPA and SAM reactivity have been documented. Most consistently, cortisol declined after induced relaxation (DiPietro et al., 2008; Field et al., 2004; Teixeira et al., 2005; Urizar et al., 2004), while adrenocorticotropin hormone (ACTH) has not been investigated so far. Effects on NE and E are controversial (Field et al., 2004, 1999; Teixeira et al., 2005). Finally, lower heart rate and blood pressure have been observed after practicing a relaxation exercise (Bastard and Tiran, 2006; DiPietro et al., 2008; Nickel et al., 2006; Teixeira et al., 2005).

Although these studies have shown the usefulness of relaxation methods during pregnancy, they are quite diverse and include a wide range of interventions like applied relaxation, massage, hypnotherapy, yoga therapy, verbal instructions, breathing instructions, PMR and GI. Whereas especially yoga therapies (Narendran et al., 2005; Satyapriya et al., 2009) and PMR over a longer period (Field et al., 1999, 2004; Nickel et al., 2006) are likely to enhance psychobiological wellbeing, most studies specify only insufficiently the particular content of the interventions, control conditions are often lacking, randomized controlled trials are sparse, and results are heterogeneous with respect to the pattern of variables that are affected by the intervention. In addition, so far only few research groups directly evaluated if different relaxation techniques have a different impact during pregnancy (Field et al., 2006a, 2004, 1999; Teixeira et al., 2005). Field et al. (1999) compared a massage therapy and a PMR relaxation group over 5 weeks. The massaged pregnant women showed reduced anxiety levels, stress hormones, fewer sleep disturbance, back pain and obstetric and postnatal complications. Women in the PMR group only had decreased anxiety levels after their first session. Teixeira et al. (2005) investigated active versus passive relaxation techniques in pregnant women. Active relaxation was based on hypnotherapeutic methods whereas women in the passive relaxation group sat quietly, reading a women's fashion magazine. A reduction in anxiety and heart rate, but not in stress hormones was found after the active relaxation. The effects of passive relaxation were comparable to those evoked by active relaxation. The diverse outcomes in these studies indicate that different relaxation techniques can have different impact on psychobiological wellbeing in pregnant women.

Therefore, the aim of the present study was to directly compare the immediate effects of two brief active relaxation exercise (PMR and GI) on pregnant women's general psychological, endocrine and cardiovascular functioning. We predicted that — compared to the passive relaxation control condition — both active relaxation techniques will have a positive impact on subjective and objective indicators of relaxation. Active relaxation was hypothesized to elevate the level of perceived relaxation and lead to a greater decline in hormones associated with the HPA-axis and the SAM-system, as well as to reduced cardiovascular activity.