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Do infants exhibit significant cortisol reactivity to the Face-to-Face Still-Face paradigm? A narrative review and meta-analysis

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ABSTRACT

The Face-to-Face Still-Face (FFSF) paradigm is a widely adopted experimental procedure to assess infants' response to socio-emotional stress during the first months of life. Previous reviews demonstrated that this procedure elicits specific behavioral responses, including an increase in negative emotionality and gaze aversion as well as a decrease in positive emotionality and social engagement. Infants also give evidence of hypothalamic–pituitary–adrenal (HPA) axis reactivity to the FFSF. Unfortunately, previous studies reported inconsistencies in the association between the exposure to the FFSF paradigm and HPA activation during the first months of life. In this paper, the HPA axis correlates of FFSF stress regulation were examined through a narrative review and a meta-analysis. A literature search was conducted on three databases (i.e., Scopus, Web of Science, PubMed) and led to 17 studies included in the review and 10 included in the meta-analysis. The findings suggested that infants tend to show a clearly observable activation of the HPA axis in response to the socio-emotional stress elicited by the FFSF paradigm, although considerable variation in methodology and sample characteristics was documented. A five-episode repeated-exposure version of the FFSF procedure emerged as a more suitable procedure to elicit a significant neuroendocrine response. In summary, the FFSF appears to elicit HPA axis activation in response to socio-emotional stress, but only in specific contextual conditions. As such, open questions remain and require continuity in FFSF research efforts.

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Introduction

The Face-to-Face Still-Face paradigm

During the last four decades, the Face-to-Face Still-Face (FFSF) paradigm (Tronick, Als, Adamson, Wise, & Brazelton, 1978) has been widely used as an experimental procedure to study socio-emotional stress regulation in young infants (Adamson & Frick, 2003). The FFSF paradigm has been increasingly adopted in infant research, enhancing our understanding of infants' capacity to cope with normally occurring ruptures in mother–infant interactions (Mesman, van IJzendoorn, & Bakermans-Kranenburg, 2009).

The typical FFSF paradigm consists of three brief episodes structured in an A-B-A sequence (Mesman et al., 2009; Tronick et al., 1978). The first "A" corresponds to the Play episode: mothers and infants interact *vis-à-vis* in a normal dyadic interaction setting. The "B" corresponds to the Still-Face episode: socio-emotional stress is elicited by the experimental manipulation of maternal responsiveness and availability to interact (Sravish, Tronick, Hollenstein, & Beeghly, 2013; Tronick & Cohn, 1989). Mothers are asked to become unresponsive and maintain a neutral facial expression. During this episode, infants exhibit the typical *still-face effect*, which consists of increased negative emotionality displays, enhanced gaze aversion, reduced positive emotionality and decreased social and communicative behaviors (Adamson & Frick, 2003; Provenzi, Borgatti, Menozzi, & Montirosso, 2015). The second "A" is the Reunion episode: mothers and infants restart normal *vis-à-vis* interaction. The Reunion episode is a context of socio-emotional stress recovery (Montirosso et al., 2015). During this episode, infants show a *carry-over effect*, which consists of a partial recovery of positive emotionality and both social and communicative behaviors and by enduring negative emotionality from the Still-Face episode (Mesman et al., 2009; Montirosso et al., 2015).

Previous reviews of FFSF literature

A first review of the FFSF literature was carried out in 2003 by Adamson and Frick and provided a historical framework, a discussion of plausible theoretical interpretations of the still-face effect and a comprehensive global picture of the FFSF state of the art. A few years later, Mesman et al. (2009) published both a narrative review to systematically revise the existent FFSF literature and a meta-analysis to assess the reliability of still-face and carry-over effects as well as the role of infants' and maternal characteristics. The meta-analysis revealed adequate validity for both FFSF effects, providing further evidence that this experimental paradigm is a reliable procedure to test behavioral stress regulation in infants. The still-face effect was very robust, independently of sample and methodological variations, including infant gender, risk status, and actual length of FFSF episodes.

More than the behavior: The hypothalamic–pituitary–adrenal (HPA) axis under stress

The review from Mesman et al. (2009) concluded favorably regarding the robustness of the FFSF procedure for what affects behavioral indices of stress regulation. Notwithstanding, during the last decade, evidence about the presence of a physiological reactivity to the FFSF paradigm has accumulated. In other words, while exposed to an unresponsive mother, infants exhibit autonomous parasympathetic (e.g., heart rate and vagal tone; Bazhenova, Plonskaia, & Porges, 2001; Montirosso et al., 2014; Moore & Calkins, 2004) and sympathetic (e.g., skin conductance; Ham & Tronick, 2009) responses as well as neuroendocrine reactivity (e.g., hypothalamic–pituitary–adrenal [HPA] axis; Haley & Stansbury, 2003; Lewis & Ramsay, 2005).

The HPA axis is a key component of the stress response system in animals and humans (Tsigos & Chrousos, 2002), and it regulates reactivity to challenging conditions through a cascade-like hormone production, ending with the secretion of cortisol (Gunnar & Donzella, 2002). Apart from stressful conditions, as part of the normal body's regulatory functions, cortisol secretion follows a circadian rhythm, with the highest production around early morning, followed by a sharp decrease during afternoon and evening, and finally reaching nadir during the night (Jansen, Beijers, Riksen-Walraven, & de Weerth,

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