



Right frontal EEG asymmetry and behavioral inhibition in infants of depressed mothers

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ABSTRACT

Recent studies have shown associations between maternal psychopathology and inhibited behaviors in infants. Moreover, physiological factors have been identified as affecting the continuity of behavioral inhibition across childhood. The purpose of the present study was to examine electroencephalogram (EEG) activity and inhibited behavior in 12-month-old infants of depressed versus non-depressed and mothers. Repeated measures MANOVAs indicated that the infants of mothers with stable psychopathology had greater relative right frontal EEG asymmetry, a pattern that typically accompanies greater negative affect and greater withdrawal behaviors. Infants of affectively ill mothers also showed more proximal behaviors toward a stranger and a novel toy than infants of well mothers, but fewer non-proximal behaviors toward their mothers. These results are discussed within a framework of behavioral inhibition for infants exposed to early psychopathologies in their mothers.

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The literature has indicated that maternal psychopathology adversely affects infants (Cicchetti & Toth, 1998; Dawson, Ashman, & Carver, 2000; Diego et al., 2004; Diego, Field, Jones, & Hernandez-Reif, 2006; Downey & Coyne, 1990; Field, 1995; Jones, McFall, & Diego, 2004). When maternal mood disorders are stable during infancy, 1-year-old infants experience delayed growth and intellectual development (Fox, Henderson, Marshall, Nichols, & Ghera, 2005). Studies have also shown a relationship between maternal psychopathology and inhibited behaviors which have been identified as precursors to social reticence with peers and ultimately anxiety and depressive disorders (Feng et al., 2008; Hirshfeld-Becker et al., 2007). Recent theories suggest that in addition to disturbed social interactions with their mothers, infants of depressed mothers also have biological and physiological vulnerabilities that may predispose them to more stability in their disturbed social interactions (Field, 2000; Jones, Field, Fox, Lundy, & Davalos, 1997). The present study examined EEG activity, interactive behaviors, and socially inhibited behaviors in infants whose mothers are stable in their depression and anxiety during the first year of life.

Brain activity patterns (via an electroencephalogram, EEG) of the children of depressed mothers were examined because previous research has consistently shown that infants and children of depressed mothers have greater relative right frontal EEG asymmetry (Diego et al., 2004; Jones, Field, Davalos, & Pickens, 1997; Jones, Field, Fox et al., 1997). Theories have suggested that the right frontal region of the brain is specialized for emotions associated with negative emotions and behavioral withdrawal (Fox, Calkins, & Bell, 1994; Henderson, Fox, & Rubin, 2001). Based on this literature, the infants of depressed and anxious mothers were expected to show greater relative right frontal EEG asymmetry. EEG patterns in infants of depressed mothers have also been shown to be stable from the neonatal stage and across the first year of development (Diego et al.,

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2004; Field & Diego, 2008). Jones, Field, Davalos, et al. (1997) also demonstrated that right frontal EEG asymmetry, a marker of depressive symptoms in adults, was temporally stable from 3 months to 3 years.

Although studies have established a relationship between maternal anxiety and behavioral inhibition, few studies have shown that depressed mothers also influence their infants inhibited behaviors (Finman, Davidson, Colton, Straus, & Kagan, 1989; Fox, Henderson, Rubin, Calkins, & Schmidt, 2001; Fox, Schmidt, Calkins, Rubin, & Coplan, 1996). Moreover, depression and anxiety are very often comorbid (Durban, Klein, Hayden, Buckley, & Moerk, 2005; Kasch, Rottenberg, Arnow, & Gotlib, 2002).

Studies have frequently shown lower rates of behavior and affective expression of depressed mothers interacting with their infants (Cohn, Matias, Tronick, Connell, & Lyons-Ruth, 1986; Durban et al., 2005; Feng et al., 2008;) and the infants of depressed mothers have also been less socially interactive or maladaptive in their social interaction patterns (Shamir-Essakow, Ungerer, Rapee, & Safier, 2004), suggesting that these infants may be learning or imitating their mothers' depressive and anxious symptoms. Social experiences with a depressed parent (along with temperamental or genetic predispositions) could thereby make the infant vulnerable for the increased social withdrawal and internalizing behaviors noted in preschool children of depressed mothers (Feng et al., 2008; Field et al., 1996). Although many studies have examined social withdrawal and behavioral inhibition, these studies have been limited to children of mothers without psychopathologies (Kagan & Snidman, 1991). Studies have also shown that behavioral inhibition is associated with right frontal EEG asymmetry (Henderson et al., 2001) suggesting the need to further explore this relationship in infants of depressed and anxious mothers.

The primary purpose of the present study was to examine regional EEG activity and social behaviors in the form of behavioral inhibition in infants whose mothers exhibited stable depression across the first year of post-natal life. There appears to be, however, no studies to date that have examined the pattern of resting frontal brain electrical activity (EEG) and behavioral inhibition in children at risk during the first year of post-natal life. We predicted that infants of depressed mothers would exhibit greater relative right frontal EEG activity at rest and more behavioral inhibition compared with disinhibition than infants of non-depressed mothers. Based on previous studies that have shown delayed growth and intellectual development in infants of depressed mothers (Field, 1992), we also predicted that infants of depressed mothers would be delayed in their mental development compared with infants of non-depressed mothers.

1. Method

1.1. Participants

Forty, 1-year-old infants and their mothers participated in this study. Of those 40 dyads, 30 were stable in their group defined "stable depressed" ($N = 16$) or "stable non-depressed" ($N = 14$), $\chi^2 = 8.28$, $p < 0.001$. The children (14 girls) averaged 12 months of age ($M = 12.5$, $SD = 0.9$) and their mothers were low socioeconomic status (Hollingshead, 1975), $M = 4.5$, $SD = 0.05$, high school educated ($M = 10.5$, $SD = 2.2$), in their late teens ($M = 19.5$, $SD = 2.6$) and distributed 53% African American, and 47% White, Hispanic.

The depressed and the non-depressed groups did not differ on demographic factors (Table 1) except that, as expected, the mothers in the depressed group reported more symptoms of depression ($M = 24.9$ versus 9.3) on the Center for Epidemiological Studies-Depression Scale (CES-D; Radloff, 1977) and higher scores for anxiety ($M = 15.6$ versus 9.4), depression ($M = 18.9$ versus 8.0) and hostility ($M = 20.3$ versus 8.3) on the Profile of Mood States questionnaire (POMS; McNair, Lorr, & Droppleman, 1971).

1.2. Procedures

Mothers and their infants participated in a longitudinal study on maternal depression effects on infant development and were seen at the newborn period and again at 1-year of age. During the laboratory session, mothers were asked to complete the CES-D (Radloff, 1977), a demographic questionnaire (Hollingshead, 1975), and the POMS (McNair et al., 1971).

The children participated in an EEG session, an inhibition paradigm (modeled after Calkins, Fox, & Marshall, 1996; Kagan & Snidman, 1991), and a Bayley Scale for Infant Development (Bayley, 1969). Growth measures were also obtained (head circumference, length, and weight). All sessions lasted approximately 1 h and the order of procedures was randomly presented.

1.2.1. Maternal report measures

Mothers in the depressed group had been diagnosed as depressed on a clinical interview (the Diagnostic Interview Schedule, Robins, Helzer, Croughan, & Ratcliff, 1981) and had elevated CES-D scores at the newborn assessment and at any subsequent laboratory visits. During the 1-year laboratory session the mothers again completed the CES-D and the POMS.

1.2.2. Inhibition condition

The infants were observed in a playroom for three brief episodes: (1) novel room: 5 min of freeplay with mother in playroom; (2) novel person: stranger enters playroom and presents novel toy while keeping head down for 1 min, stranger plays with toy for 1 min, stranger invites child to play for 1 min and (3) novel objects: stranger presents electronic robot for 2 min and tunnel for 2 min.

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