



Does infant negative emotionality moderate the effect of maternal depression on motor development?



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ABSTRACT

Maternal depression represents an important social/environmental factor in early childhood; however, its effect on children's motor development may vary depending on the role of infants' dispositional variables. The objective of this study is to investigate the effect of the interaction between maternal depressive symptoms in the first two years of a child's life and the child's temperamental negative emotionality on motor development during this time. Using a cross-sectional study, we assessed 272 infants aged 0 to 24 months old and their mothers. We measured the following variables: maternal depression, infant's negative emotionality, and motor development. A three-way interaction effect highlights that negative emotionality in infants and maternal depression together affect children's overall motor growth trajectory. Infants with low negative emotionality display no effect of maternal depression on motor development. Conversely, infants with high negative emotionality seem to be more susceptible to the effect of maternal depression. Specifically, high maternal depression tends to foster the negative effect of infant's negativity on motor development across time, albeit not significantly. Finally, the absence of maternal depression significantly buffers negative temperament in infants. Findings highlighted the importance of integrating different perspectives when describing early motor growth. In fact, only when considering the interdependence of potential predictors their effect on the motor growth significantly emerges. Screening for early temperamental vulnerability might help in tailoring interventions to prevent maternal depression from affecting infants' motor development.

1. Introduction

Motor development is described as the gradual acquisition of several motor skills, defined as progressive milestones belonging to the fine and gross motor domains. Motor growth is pivotal in children's experience of the world, supporting their exploration and therefore their cognitive development [1,2]. Moreover, general development is deeply rooted in motor development to the extent that motor growth is implicated in several neurodevelopmental disorders, such as autism spectrum disorders [3] and attention-deficit hyperactivity disorder [4,5]. So far, very few study addressed the investigation of interconnected biological and environmental influences on motor development.

According to the current neurobiological models [6], child development is shaped by continuous mutual exchange of parental features (nurture) and children's inborn dispositions (nature). In fact, great variability is described in the delay and achievement of motor milestones due to the influence of both genetic/inborn and contextual variables (e.g., socioeconomic status, parent-child interactions).

Therefore, the study of motor development should be framed within the epigenetic landscape framework, where organism-context interactions lead toward a progressively more restricted developmental pathway [7]. The principal aim of the present study is to investigate the effect of the interaction between maternal emotional state and child's temperament on motor development.

1.1. Maternal depression, child temperament, and motor development

As regards contextual factors, the quality of maternal emotional states represents the first and most important social environment for infants in early childhood. Depressive symptoms affect from 3% to 60% of mothers in the postpartum period [8,9], and 30% of women in nonclinical samples still display symptoms of major depression beyond the first year of the child's life [10]. Maternal depression is expressed as difficulties in dealing with the parental role and as poor quality of the mother-child interaction, meaning that depressed mothers are reported to be less responsive to their children's needs and signals and are

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unlikely to provide reciprocal parenting [11]. Moreover, negative, intrusive, withdrawn, or less sensitive interactive exchanges are described in depressed mothers [12,13]. Therefore, maternal depression affects children's development through poor parenting and maladaptive/dysfunctional interactions, with consequences on socioemotional development and neurocognitive functioning extending to school age [14,15] and even to preadolescence [16,17]. In addition, clinical outcomes have been described in children of depressed mothers, in terms of increased risk for clinical depression, anxiety and disruptive behaviors [18]. More specifically, poor motor development has been reported in infants of postpartum depressed mothers [19,20]. In particular, depression occurring in the prenatal period has been linked to poor neonatal motor control [21], and chronic maternal depression is associated with delayed walking in the first year of a child's life (even if variations are within the expected motor developmental parameters) [22]. In the presence of maternal depression, the quality of parenting decreases, with mothers providing sub-optimal levels of stimulation during the earliest interactive exchanges [19]. Some authors [20] have proposed that less maternal attention and sensitivity toward infant's cues may result in infants not being able to use their mother as interactive partners and, for this reason, resulting in an over/under motor-exploration.

However, several studies [23–25] have underlined that the influence of maternal depression on children's development should not be considered linear or direct. A meta-analytic study highlighted the importance of identifying potential moderators, that account for the strength of this association and the different risks for adverse outcomes in children of depressed mothers [26]. Concerning organism variables, a child's temperament is defined as a constitutionally based set of individual differences in reactivity and self-regulation in the domains of emotions, activity, and attention [6,27]; it is influenced by heredity, maturation, and experience. According to Rothbart's model (1989), three factors define a child's temperament, namely surgency/extraversion, negative affect, and effortful control [28].

Infant temperament is reported to be responsible for the variability in the consequences of maternal depression on child development [29]. Moreover, the differential susceptibility model [30] suggests that specific temperamental traits, such as infant negative emotionality and regulatory abilities, define the perimeter of environmental effects on child development, limiting or extending parental effects.

In Rothbart's model (1989), negative emotionality and emotion regulation abilities involve individual differences in arousal of fear, frustration, and sensitivity to negative environmental cues. Negative emotionality has often been associated with internalizing and externalizing problems [31,32]. Moreover, emotional self-regulation, which includes negative emotionality and emotion regulatory abilities, is the most susceptible to the environmental effect trait [33]. In particular, mothers with depression tend to show higher negative emotions and difficulties in emotion regulation; therefore, they are more likely to react negatively to children's negative emotionality [23]. In turn, negative parenting elicits negative emotions and reactions in children. Finally, the presence of an unadaptable temperament is found to be a risk factor in infants' motor development [20], which is attributed to maternal difficulties in dealing with this trait.

In conclusion, researchers have underscored the interdependent roles of maternal state and infant temperamental traits with regard to child development, highlighting that mothers of unpredictable infants are more likely to be depressed than mothers of predictable infants [12] and that infant temperament moderates the effect of maternal depression on infant growth [34]. Most studies have detailed the effects of these associations on behavioral and socioemotional outcomes, but less is known about motor development. So far, very few study highlighted the negative role of difficult emotionality in the motor growth of depressed mothers' children.

The current cross-sectional study aims to explore the interconnection of environmental and inborn temperamental determination on

child motor development across the first two years of life, placing itself in the emerging perspective of studies on child development [6] and on centrality of motor growth in early infancy [2,35]. It was hypothesized that the effect of maternal depression on children's motor growth is expressed differently — that is, increased or decreased — according to two specific moderators: (a) the child's level of negative emotionality and (b) the passage of time (months of life). First, the detrimental effect of maternal depression is expected to increase over time. Second, low infant negative emotionality is expected to protect a child's motor development from the negative effect of maternal depression; in contrast, high negative emotionality is expected to intensify the negative effect of maternal depression.

2. Methods

2.1. Participants

Data from 272 mother-infant dyads was analyzed. Overall, we recruited a sample of 299 couples from the normative population. Mothers' exclusion criteria were a history of mental disorders or being currently referred to mental health services. Five infants failed to complete the motor protocol, and other 22 couples were excluded for the incompleteness of the maternal protocol. Mothers were 18–46 years old (mean age = 33.87, $SD = 4.92$). In our sample, 151 mothers (56%) had a high educational level (corresponding to 6 or higher in the International Standard Classification of Education [ISCED] 2011), 62 (23%) had a medium educational level (ISCED levels 3 to 5), and 55 (20%) had a low level of education (ISCED levels 0 to 2). A subgroup of 230 mothers (84%) had an occupation, and most participants (94.6%) were living together with the partner.

Infants were between 0 and 23 months old (mean age = 10.09 months, $SD = 6.64$); 139 (51%) were boys, and 133 (49%) were girls. None of them had encountered problems during pregnancy or birth, and they were all born at term, with a mean birth weight of 3.31 kg ($SD = 0.47$). Infants' age distribution over time is presented in Fig. 1.

2.2. Procedure

We recruited the dyads from the Babylab Database of the [masked for blind review] and with the collaboration of some pediatricians from Northern Italy. The procedure took place in a laboratory of the [masked for blind review]. The entire procedure took two sessions, each lasting about 60 min, during which we administered the Peabody

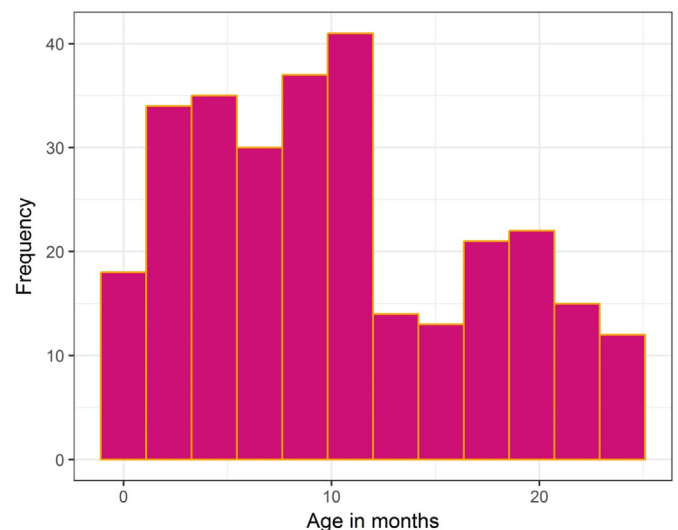


Fig. 1. Infants' age distribution.

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