

Preterm Birth's Effects on Attachment

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ABSTRACT

The attachment established between the caregiver and the infant is a fundamental factor affecting mental health, starting from the prenatal period and developing during infancy. Prematurity is among the factors that influence the quality of attachment, making it difficult for healthy parent-child relationships to be established. Premature infants treated in intensive care units must separate emotionally and physically from their caregivers, putting them and their parents at risk of mental health problems and interrupting the attachment process. With the increase in premature birth rates, studies have investigated the relationship between attachment quality and premature birth, concluding that premature birth negatively affects secure attachment and that attachment quality decreases as gestational age decreases and neonatal intensive care time increases. Protective interventions and multidisciplinary approaches are recommended to reduce this negative effect, and long-term studies are needed to better understand the relationship.

Keywords: Attachment, neonatology, pediatric psychiatry, premature birth

Introduction

The perinatal period and the first years of childhood are critical for mental health throughout life. Brain development during the prenatal period and the first 3 years of life progresses at a unique pace, with over 1 million neural connections formed per second (1). Therefore, every positive or negative experience during this period has an impact on the infant's neural connections, shaping their future social, emotional, and cognitive functioning.

Physical health has direct and indirect effects on mental health. A comprehensive assessment includes not only a child's mental health but also physical, cognitive, and developmental evaluation. The "DC: 0-5 Diagnostic Classification of Mental Health and Developmental Disorders of Infancy and Early Childhood" revised by Zero to Three in 2016

and translated into Turkish in 2020, addresses mental health in the first five years of childhood through a five-axis system. The third axis is dedicated to the child's physical health, with subcategories such as prematurity, prenatally detected medical conditions, acute-chronic medical conditions, history of procedures performed, and recurrent or chronic pain (2).

Biologically immature, preterm infants are at risk of developing motor, cognitive, and socioemotional complications. Physical health problems faced by preterm infants necessitate hospitalization in the neonatal intensive care unit, requiring separation from caregivers. Both caregivers and preterm infants may struggle to cope with this process, which can negatively impact their psychological health during the acute phase and subsequent years.

The literature contains numerous studies on the short- and long-term psychological problems caused by preterm birth, covering

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Received: 05.07.2024 **Accepted:** 31.07.2024



a wide range of topics, such as mothers' postpartum mental health issues, parent-infant attachment, and the potential psychiatric problems that preterm born children may face in the long term.

According to attachment theory, early relationships have significant effects on a child's development (3). Secure attachment is a protective factor for social and emotional development. It also plays a role in the acquisition of important mental health functions, such as self-esteem, coping skills, and resilience (4). On the other hand, insecure attachment can lead to problems, such as emotion regulation deficits, stress coping difficulties, and vulnerability, thereby creating a risk for psychiatric disorders (5). Secure attachment requires a caregiver who is continuously responsive, consistent, sensitive, and available (6). Preterm infants' families may have difficulty providing these conditions. Therefore, the effects of preterm birth on attachment have been a subject of interest in recent years.

This review examined the literature on the effects of preterm birth on attachment. The aim of this study is to provide useful information to clinicians and to provide ideas for future studies on this topic.

Preterm Birth: Definition, Risk Factors, and Epidemiology

The World Health Organization defines preterm birth as the onset of labor before the 37th week of pregnancy (7).

- Late preterm births: Births between 34 and 37 weeks of gestation.
- Moderately preterm births: Births between 32 and 34 weeks of gestation.
- Very preterm births: Births between 32 and 28 weeks of gestation.
- Extremely preterm births: Births before 28 gestational weeks (7).

Risk factors for preterm birth include maternal factors such as genetic predisposition, uterine anomalies, early (<18) or late (>40) maternity, and maternal infections, as well as psychosocial factors (8,9,10,11). Psychosocial risk factors include low socio-economic status, low education level, maternal anxiety/depression, divorce, separation or death, inadequate prenatal care, and maternal use of psychoactive substances (11).

Approximately 13.4 million babies (9.9% of all births) were born preterm worldwide in 2020. 15% of these births occurred before 32 weeks of gestation (12). According to data from the Turkish Ministry of Health, the preterm birth rate in Turkey was 12.9% in 2022, and the rate of births before 32 weeks of

gestation was 10.8% (13). There has been a significant increase in preterm birth survival rates both globally and in Turkey over the last 20 years. Timely interventions for preterm births have led to an increase in the preterm birth rate and a decrease in mortality rates (14). Between 1990 and 2010, the preterm birth rate in developed countries increased from 2 million to 2.2 million. The increase in the number of preterm infants born between 32 and 37 gestational weeks was reported to increase the burden on countries. This increase has also led to increased morbidity rates in various fields for families and communities (15).

Preterm infants are born before they are fully developed in the womb and face serious health problems. The health problems of preterm infants vary according to gestational age and birth weight. Infants born earlier and with lower birth weights have a higher risk of experiencing health problems (16). In the United Kingdom, neonatal mortality rates increased between 2014-2021, and this increase was attributed to the increase in the number of preterm infants born before 24 weeks of gestation (17). Health problems such as respiratory distress syndrome, intraventricular hemorrhage, cardiac issues, infections, and feeding difficulties are common in preterm infants (16). Due to such health problems, it has been reported that approximately 900,000 preterm infants died worldwide in 2019 (12).

In recent years, especially with the rapid advancements in medicine, even much earlier born infants with lower weights can survive. For example, in Turkey in 2024, a "micro preemie" girl born at 24 weeks of gestation, weighing 370 grams, overcame the vital risk after a 155-day treatment process in the intensive care unit and was discharged (18). While these developments are encouraging, the long-term physical and mental developmental trajectories of children born at extreme prematurity who can be kept alive remain an area that requires further investigation.

Effects of Preterm Birth on Mental Health

Preterm infants having an immature neurobehavioral profile, being separated from their mothers early, receiving treatment in the neonatal intensive care unit, being perceived as a high-risk/special baby, and emerging perinatal complications all put them at risk for mental health problems (14,19). It has been reported that exposure to pain in the neonatal period leads to changes in stress regulation in the first few months of life, and in later developmental periods, it causes more behavioral and attention problems (19).

Studies are showing that individuals born prematurely have more growth and developmental disorders, attention deficit hyperactivity disorder, autism spectrum disorder,

learning difficulties, language development delays, emotional problems, and anxiety disorders in later life stages compared to those born at term (20,21,22). These studies have shown that preterm birth increases the risk of attention deficit hyperactivity disorder by 3 times and the risk of autism by 3.3 times compared to term births (23,24). According to a meta-analysis evaluating the cognitive functions of preterm infants born before 32 gestational weeks, preterm children have lower IQ scores compared to term infants, the presence of bronchopulmonary dysplasia is an important factor affecting long-term cognitive development, and each increase in the rate of bronchopulmonary dysplasia is associated with a decrease in IQ scores (25).

Studies examining the effects of preterm birth on language development have found that the preterm group scored significantly lower on language and speech assessment tests compared to the term group and had a higher risk of language development delays (21,26). A study that tracked very preterm and term individuals for 11 years found that very preterm infants who experienced high stress around the time of birth showed more internalizing symptoms at age 11. The study revealed that emotional skills acquired at 18 months were a significant predictor of these outcomes. Therefore, experiencing stress during infancy because of being born very preterm is a risk factor for emotional problems in pre-adolescents (27).

This meta-analysis compared the risk of mental illness in childhood, adolescence, and adulthood between individuals born with extremely low birth weight (<1000 grams) and normal birth weight. The study found that the extremely low birth weight group had more inattention, hyperactivity, internalizing, and externalizing problems in childhood, a higher risk of behavioral and oppositional problems, autism symptoms, and social difficulties in childhood, more hyperactivity, internalizing problems, and social difficulties in adolescence, and more depression, anxiety, and social difficulties in adulthood (20). A study examining the psychiatric symptoms of individuals born moderately preterm (24-32 gestational weeks) and at full term in adulthood discovered that the overall rates of mental health issues were higher in those born early compared to term-born individuals. The study also found that the risk of mental health problems was linked to low intelligence quotient, and the specific cluster of mental health issues was non-specific (28).

Attachment Theory and Attachment Disorders

Attachment is defined as the infant's tendency and desire to seek comfort, support, physical or emotional satiety, and

protection from the caregiver (29). According to Bowlby's (30) attachment theory, infants can only sustain their lives in the presence of a primary caregiver who is willing to care for and protect them. It is stated that the attachment relationship begins in the first hours and days after birth, when excessive stimulation occurs in the infant's central nervous system. Infants initiate their first interaction with their mother through innate behaviors such as sucking, following, smiling, crying, and touching. Therefore, according to Bowlby (30), it is important for mothers to immediately hold and breastfeed the baby after birth.

Ainsworth and Bell (6) defined attachment as the emotional bond that an individual establishes with others and stated that for the development of a secure attachment, the infant must have a caregiver who responds consistently, sensitively, and is always available. According to Ainsworth and Bell (6), the attachment styles of children with their parents are shaped by the way parents care for and respond to their children. In the 1970s, Ainsworth's Strange Situation Test research observed how children aged 12 to 18 months reacted when they were separated from their mothers and reunited. As a result of this research, the defined attachment styles were categorized into three categories: "Secure Attachment, Avoidant Attachment, and Ambivalent/Resistant Attachment". Secure attachment is the most common and healthy form of attachment. Securely attached infants can use their mothers as a secure base to explore the environment. They may show various stress reactions when their mothers are absent, but they respond positively when they return home. Avoidant attachment is the second most common attachment style. These infants are not concerned with the whereabouts of their mothers and explore the environment, are minimally disturbed by their mother's absence, and appear to ignore their mothers when they return. Ambivalent/Resistant attached infants have difficulty separating from their mothers to explore, and although they try to make contact when their mothers return, they have difficulty calming down or returning to exploration. Ainsworth and Bell (6) emphasized in this study that the quality of attachment is determined more by the infant's response to the mother's return than by his/her response to his/her departure. For many years, attachment has been studied under these three categories. However, as the number of studies on attachment increased, the presence of a group that did not fit into these three categories became noticeable. Main and Solomon (31) worked on this unclassified group and defined a 4th category called "Disorganized Attachment". Disorganized attachment is the rarest but the most unhealthy form of attachment. Infants with this attachment style do not

exhibit an organized strategy. Even under intense stress, they may behave in ways such as staying away from the caregiver or clinging tightly to the caregiver (32).

The interaction between environmental (especially parental) and genetic factors in infancy and childhood leads to individual differences in attachment behaviors in later life (33). Attachment behaviors are interpersonal actions that aim to increase an individual's sense of security, especially during stressful times. These interpersonal patterns are quite stable and are known as "adult attachment styles" in adulthood. The impact of adult attachment styles on psychosocial factors, such as social functioning, coping, stress response, and psychological well-being is important (34).

Attachment disorders, which emerge before the age of 5 and are caused by extremely deprived and pathogenic caregiving conditions, are defined as "significantly impaired and developmentally inappropriate social relationships in most social contexts" (35). The official diagnostic classification of attachment disorders was first made in the Diagnostic and Statistical Manual of Mental Disorders: DSM-3, and the criteria were revised in DSM-3-TR and DSM-4. Currently, in the Trauma and Stressor-Related Disorders section of DSM-5, they are classified as "Disinhibited Social Engagement Disorder" and "reactive attachment disorder (RAD)" (36).

RAD is characterized by mixed feelings about seeking comfort from a caregiver, emotional withdrawal, lack of interest in socializing, reduced positive emotions, and unexplained fear or irritability. RAD may be observed in children who exhibit limited or no positive emotions. On the other hand, children with disinhibited attachment may display overly intrusive behavior, struggle to set appropriate social and emotional boundaries, and act overly friendly toward strangers. It is important to differentiate RAD from other psychological conditions that involve overly vigilant behavior and behaviors associated with autism spectrum disorders (36,37). Minnis et al. (38) conducted the first epidemiological study focusing on the prevalence of RAD in the general population. They found a prevalence of 1.4%. No studies on the prevalence of RAD have been found in our country. A study has reported that the risk factors for RAD include the presence of mental disorders in parents, in-utero smoking exposure, advanced paternal age, and being a single mother (39). It has been shown that the rates of receiving a RAD diagnosis are associated with induced birth, low birth weight, preterm birth, and staying in the intensive care unit (40).

Effects of Preterm Birth on Mother-infant Attachment

The impact of preterm birth on the mental health of both parents and infants has been evaluated. A key focus of these studies was the effect of preterm birth on the attachment process between the infant and caregiver, especially the mother.

Perinatal stress, which is a risk factor for preterm birth, also emerges as a consequence of preterm birth (41). It is thought that changes in uterine blood flow caused by maternal stress or cortisol passing from the mother to the fetus through the placenta may increase the risk of preterm birth (42,43). Parents of a preterm infant are at increased risk of depression and anxiety, and these emotional difficulties can stem from uncertainties about the infant's health and future (44). A systematic review discovered that 40% of mothers with preterm infants experienced postpartum depression. The review revealed that enduring depression was linked to earlier gestational age, lower birth weight, ongoing physical illness in the infant, and a perceived lack of social support (45). However, a prospective cohort study that followed mothers of preterm infants through pregnancy, delivery, and the postpartum period did not find a significant relationship between preterm birth and postpartum depression (46).

The presence of mental health issues in mothers can make it more difficult to establish a healthy mother-infant relationship, which is necessary for secure attachment. The results of studies on mother-preterm infant interactions are mixed. A meta-analysis found a negative relationship between maternal stress levels, the presence of depression, and secure attachment (47). Mothers of preterm infants have been observed to show less consistent, sensitive, and accepting behavior, and they may have unrealistic fears about their infant's safety. They also tend to engage in fewer emotional mirroring interactions. Although some studies found no differences in mother-infant interactions in the first 6 months between the preterm and full-term groups, others found that the interactions of preterm infants and their mothers were of higher quality than those of full-term infants. These studies concluded that mothers of preterm infants were more responsive, affectionate, and engaged in more direct, active, and controlled interactions with their infants, even if they smiled less and had less physical engagement (48,49). The interactions between preterm and term infants and their mothers showed the most differences in the first six months. By the corrected age of 12 months, the likelihood of developing secure attachment in preterm infants becomes similar to that in term infants (50).

Premature infants admitted to intensive care units for respiratory, nutritional, and other medical interventions are required to be separated from their caregivers emotionally and physically. Therefore, the attachment process of infants with limited social interaction may be disrupted (51). Increased length of stay in the intensive care unit, presence of respiratory problems, and significant neurological impairment have been associated with insecure attachment (50).

The findings of a study conducted in our country suggest that mothers who gave birth before the 32nd gestational age experienced higher anxiety levels at the 16th month after birth. Furthermore, infants with better mother-infant interaction exhibited higher cognitive development scores. The study also found that mother-infant interaction and secure attachment were similar in term and preterm healthy children. It was emphasized that it is not premature birth itself, but rather its medical, developmental, and/or neurological consequences that may affect mother-infant interaction and attachment (52).

A previous study found that premature infants born before 26 weeks of gestation had a 23% rate of secure attachment, whereas those born after 26 weeks had a 69% rate. The study emphasized that secure attachment is linked to better cognitive development, and the risk of insecure attachment increases as gestational age decreases (53).

In a study conducted in the Netherlands, researchers examined the attachment relationships between premature infants and term infants with their parents. The study found that the attachment scores of families with premature infants were higher than those of families with term infants. These findings suggest that in resource-rich developed countries, parents of premature infants may have higher levels of attachment compared with parents of infants born at term (54).

Multiple studies on maternal attachment have been conducted in our country. One such study was a descriptive and cross-sectional research involving 340 mothers in the maternity ward. The research revealed statistically significant maternal attachment in mothers aged 35 and older, those living in extended families, who described the birth process as very comfortable and easy, held their baby in the first 10 minutes, and had no concerns about the care of their baby (55). In another descriptive study involving 218 mothers with premature infants, it was found that there was a positive correlation between the gestational weeks of the babies and the scores on the Maternal Attachment Scale. Additionally, there was a negative correlation between the length of stay

in the neonatal intensive care unit and the gestational age of the babies (56).

Temperament is a broad concept conceptualized as individual differences that emerge in infancy, remain relatively stable throughout life, and shape the foundation of the child's later personality. While studies have shown that preterm infants have less regulated and more active temperaments than full-term infants, some have not detected differences in temperament between the two groups. A meta-analysis on temperament characteristics in preterm infants found that preterm infants showed higher physical activity, less focus, and less sustained attention (19). Some studies have also shown that preterm infants are more passive, less alert in interactions, exhibit more compulsive adaptation behaviors, and have lower attention, play, and motor skills (50). No significant differences in emotional and behavioral development were found between preterm and full-term infants with adaptable temperament. However, preterm infants with a "compulsive" temperament showed more behavioral problems, eating problems, lower personal-social skills, and lower language-speech skills than full-term infants. However, the same study indicated that not only the temperament characteristics of the infants but also the behavioral patterns and sensitivity levels of the mothers shape the attachment through mutual interaction. It is stated that the combination of a sensitive mother and a preterm infant with an adaptable temperament is protective for secure attachment, whereas the combination of a controlling mother and a preterm infant with a compulsive-compliant temperament is risky for insecure attachment (57). The interactions between attachment, parenting styles, and temperament are complex and have been the subject of discussion in recent years. The consensus is that attachment and temperament influence each bidirectionally, and both are open to being affected by environmental factors such as parental sensitivity (58).

Effects of Premature Birth on Father-infant Attachment

Research on parents of premature infants has primarily focused on the mother-child relationship. Comparatively fewer studies have examined father-infant interactions. It has been reported that healthcare providers in neonatal intensive care units tend to assign a greater role to mothers in infant care, which can make mothers feel isolated and overburdened (59). Studies emphasize that fathers' involvement in the treatment of premature infants in neonatal intensive care units benefits the family (60).

A meta-synthesis study reported that fathers of premature infants go through 5 stages:

- 1) Unfamiliarity with the baby and lack of emotional bond,
- 2) Taking on the caregiver role and the role of the father,
- 3) Accepting the baby as their own,
- 4) Adopting the transition to having the baby at home,
- 5) Normalizing family life (61).

A study comparing the attachment of premature and full-term infants to their mothers and fathers found that full-term infants showed secure attachment to both parents, whereas premature infants, especially males, had lower attachment scores with both parents. The most important predictor of father-child attachment was the child's developmental status (62). Another cross-sectional study was conducted with 32 fathers of premature babies born before 37 weeks' gestation and hospitalized in a neonatal unit. The researchers used the paternal postnatal attachment scale and found that the infant's gender, father's age, and father's education level did not significantly affect the attachment of premature infants and their fathers. According to this study, the application of kangaroo care increased fathers' attachment scores (59).

Mothers of premature infants had higher postpartum depression scores than fathers in a study conducted in our country. The depressive process in fathers has negative effects on the cognitive development of premature infants (63). A systematic review investigating the effects of early interventions for fathers of premature infants in neonatal intensive care units noted that there are a limited number of studies in the literature, mostly focused on practices such as skin-to-skin contact. This review concluded that interventions aimed at increasing fathers' participation in the treatment process reduced fathers' anxiety and stress levels and increased their attachment scores (64).

Effects of Premature Birth on Adult Attachment Styles

Healthy early relationships formed in infancy contribute to a person's overall well-being, ability to form close relationships, and development of positive attachment styles in later life. Premature birth is a risk factor for the establishment of healthy early relationships. Although there are many studies on the parent-preterm infant attachment relationship, relatively few have examined the effect of premature birth on attachment organization during post-childhood. There are also relatively few studies on the long-term psychiatric consequences of premature birth, and only a small portion of these focus on attachment.

There is evidence that adults born prematurely have a lower quality of attachment to their mothers, lower self-esteem, and less emotional control. One study evaluated adults who were born prematurely and received kangaroo care in the intensive care unit and found that those who received this method were more accepted by their families and had a reduced indirect suicide risk compared with the group that did not receive it (65).

Individuals born prematurely tend to receive lower quality attachment scores as they get older and exhibit more dismissive attachment styles (66). A study on the attachment styles and romantic relationships of young adults born with very low birth weight found that the case group developed more avoidant attachment styles and had lower attachment scores associated with higher anxiety levels, compared to the control group (67). Another study concluded that while individuals born prematurely could form close relationships in young adulthood similar to their full-term counterparts, the premature group showed higher emotional reactivity and greater death anxiety (68).

Protective Interventions

Family-based, personalized interventions starting from the newborn's hospitalization period and covering the transition to home after discharge; reduce the mother's stress and depression, increase their self-confidence, and positively affect the mother-infant interaction. To foster a strong and healthy bond between a baby and its mother, it is essential to provide the mother with education on infant care and childrearing during the early years. This can have a lasting impact on the child's life. It is also important to teach mothers how to cope with stress, build their self-awareness and self-confidence, and offer supportive psychotherapy for expectant mothers (29). Parents of preterm infants report that they can cope with the situation more easily when they are present in the intensive care unit together with the baby and are informed about the baby's condition (60).

The kangaroo method is recommended to contribute to reducing infant mortality and morbidity and promote breastfeeding. The kangaroo method was first introduced in 1978 by Edgar Rey Sanabria in Colombia (69). The World Health Organization's four components of the kangaroo method are early, continuous, and prolonged skin-to-skin contact between the mother and the baby, breastfeeding, early discharge from the healthcare facility, and close follow-up at home (70). Meta-analyses are showing that this method reduces mortality and morbidity rates in preterm and low birth weight infants (71,72,73). It has been shown that breastfeeding is extended by about 4 months with the

kangaroo method, and thus, neonatal sepsis, hypothermia, hypoglycemia, and recurrent hospital visits are reduced, vital signs improve, head circumference increases, and pain scores decrease in infants who undergo this method (69). According to studies investigating the effects of the kangaroo method applied to preterm babies on attachment; this method stabilizes the physiological functions of the preterm baby, increases breastfeeding and weight gain, positively affects the mother-baby attachment, and reduces maternal stress (74,75,76,77).

Protective measures such as:

- Screening for preterm birth risk factors
- Monitoring high-risk pregnancies
- Support expectant mothers from the pre-pregnancy period to the postpartum period in terms of mental health
 - Better and more comprehensive pain management in neonatal intensive care units
 - Shorter hospital stay
 - Supporting mother-father-infant interaction in intensive care units
 - Continuing caregiver support after discharge
 - Education about infant care
 - Mental health screening for preterm infants

Conclusions and Recommendations

The perinatal period and the first years of childhood are critical for lifelong mental health. Preterm birth directly affects the physical health of infants and causes psychosocial stressors.

Studies have shown that preterm birth is a risk factor that can negatively affect infant attachment, neurodevelopment, temperament, and mental health. Attention should also be drawn to the negative effects of preterm birth on parental mental health. Protective interventions and multidisciplinary follow-up are necessary for preterm infants aiming for healthy mental development. In the post-preterm birth process, factors such as attachment, mother-infant interaction, parental mental health, and infant mental health can vary from month to month. Short-term follow-up or cross-sectional studies may lead to conflicting results. Most of these studies have limited samples and relatively short observation periods. With increasing survival rates, preterm infants have been divided into more subgroups according to gestational age. Births at 24 weeks and 34 weeks differ in many ways. There are limited follow-up studies comparing subgroups defined by gestational age. In conclusion, long-term studies are needed to understand the effects of preterm birth on secure attachment.

Ethics

Authorship Contributions

Concept: E.Y.O., G.K., Design: E.Y.O., G.K., Data Collection or Processing: E.Y.O., Analysis or Interpretation: E.Y.O., Literature Search: E.Y.O., G.K., Writing: E.Y.O., G.K.

Conflict of Interest: No conflict of interest was declared by the authors.

Financial Disclosure: The authors declared that this study received no financial support.

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