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Postpartum Cognitive Functioning: A Review of Neurobiological and Psychological Factors

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Abstract. *The postpartum period is accompanied by significant biological and psychological changes that may affect a woman's cognitive function. The aim of this review is to analyze the available research on cognitive function in the postpartum period, focusing on memory, structural and functional changes in the brain, and postpartum depression. There were included scientific publications from the PubMed database. The review showed that although women often subjectively report memory loss after childbirth, objective studies often detect only minor changes or no cognitive impairment. One possible explanation for this discrepancy is the widespread stereotype of "pregnancy brain," which affects women's perceptions of their own cognitive abilities. Neuroimaging studies show that the postpartum period is characterized by significant adaptive changes in areas related to maternal behavior, emotional regulation, motivation, empathy, and the reward system. Additionally, postpartum depression is associated with changes in brain networks responsible for emotional processing and self-regulation. Overall, available data suggest that postpartum cognitive changes are typically mild and reflect adaptation to motherhood rather than significant cognitive decline.*

Keywords: *postpartum period, cognitive functioning, memory, brain plasticity, postpartum depression, maternal brain*

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Doğuşdan sonrakı dövrdə koqnitiv funksiyalar: Neyrobioloji və psixoloji amillərin icmalı

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Xülasə. *Doğuşdan sonrakı dövr qadının idrak funksiyasına təsir göstərə biləcək əhəmiyyətli bioloji və psixoloji dəyişikliklərlə müşayiət olunur. Bu icmalın məqsədi, yaddaşa, beyində struktur və funksional dəyişikliklərə və doğuşdan sonrakı depressiyaya diqqət yetirərək, doğuşdan sonrakı dövrdə idrak funksiyası üzrə mövcud tədqiqatları təhlil etməkdir. İcmaya PubMed verilənlər bazasından seçilmiş elmi nəşrlər, o cümlədən neyrogörüntüləmə tədqiqatları, uzunmüddətli tədqiqatlar və icmal məqalələri daxil edilmişdir. Ədəbiyyat icmalı göstərdi ki, qadınlar doğuşdan sonra tez-tez subyektiv olaraq yaddaş itkisi barədə məlumat versə də, obyektiv tədqiqatlar əksər hallarda yalnız kiçik dəyişiklikləri vəya heç bir idrak pozğunluğunu aşkar etmir. Bu uyğunsuzluğun mümkün izahlarından biri qadınların öz idrak qabiliyyətləri haqqında qavrayışlarına təsir edən "hamiləlik beyni" adlanan geniş yayılmış stereotipdir.*

Neyrogörüntüləmə tədqiqatları göstərir ki, doğuşdan sonrakı dövrdə qadının beyni ana davranışı, emosional tənzimlənməsi, motivasiyası, empatiyası və mükafatlandırma sistemi ilə əlaqəli sahələrdə əhəmiyyətli adaptiv dəyişikliklərə məruz qalır. Bundan əlavə, doğuşdan sonrakı depressiya emosional emal və özünütənzimləmədən məsul olan beyin şəbəkələrindəki dəyişikliklərlə əlaqələndirilir. Ümumilikdə, mövcud məlumatlar doğuşdan sonrakı idrak dəyişikliklərinin adətən yüngül olduğunu və nəzərəçarpacaq dərəcədə idrak azalması əvəzinə analığa uyğunlaşmanı əks etdirdiyini göstərir.

Açar sözlər: *doğuşdan sonrakı dövr, koqnitiv funksiya, yaddaş, beyin plastikliyi, doğuşdan sonrakı depressiya, ana beyni*

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Introduction

The postpartum period is a significant stage in a woman's life, accompanied by significant physiological, hormonal, and psychological changes. During the first months after childbirth, a woman's body adapts to new conditions associated with postpartum recovery, caring for a newborn, and developing a maternal role. During this period, many women report difficulties with memory, concentration, and performing everyday cognitive tasks.

Despite the prevalence of such complaints, research results remain mixed. While some studies indicate a slight decline in certain cognitive functions after childbirth, others find no significant differences between postpartum women and women who have not recently been pregnant. This suggests the need for a more in-depth study of the factors influencing cognitive functioning after childbirth. Current research suggests that cognitive characteristics of the postpartum period may be associated with neurobiological adaptations in the brain, hormonal changes, and psychological factors. Changes in brain structure and function contribute to maternal behavior and emotional attachment to the child, but can also influence individual cognitive processes. Furthermore, psychological factors, including stress and postpartum depression, play a significant role and can have an additional impact on a woman's cognitive functioning (Oyetunji & Chandra, 2020; Yim et al., 2015). The purpose of this review is to analyze current scientific data on women's cognitive functioning in the postpartum period and to examine the neurobiological and psychological factors that may influence cognitive processes after childbirth.

Methodology

This study is a review of the scientific literature on cognitive functioning in women during the postpartum period. The PubMed database was used to identify sources. We used English-language publications on memory, changes in brain structure and function, and psychological factors associated with the postpartum period. The review included review articles, longitudinal studies, and neuroimaging studies published in peer-reviewed journals. The selected publications were analyzed to summarize current data on the neurobiological and psychological factors influencing cognitive functioning in women after childbirth.

Results

Memory Function. Although postpartum women often complain of significant memory difficulties, numerous studies have shown no memory deficits.(Logan et al. (2014)) A study by Orchard et al. (2022) showed no differences in memory tasks between postpartum and non-pregnant women. Another study, conducted in 86 women (43 postpartum and 43 non-pregnant), assessed cognitive function. The study also found no differences in several types of memory. This study also found a positive correlation between well-being (sleep quality) and subjective memory. According to Anderson and Rutherford (2012), women may experience slight declines in working memory and delayed recall during the postpartum period. However, the observed changes were small in magnitude, suggesting that memory impairments during the postpartum period are more moderate than severe. Why do many pregnant women report severe cognitive impairment, including memory loss, when research proves the opposite? This phenomenon may be related to the stereotype that emphasizes cognitive decline as a part of pregnancy. The belief that women are becoming more forgetful and absent-minded, which is known as the pregnancy brain. (Nicolson, 1995).

This is explained by the fact that women are aware of this stereotype and begin to notice more carefully when they forget something. Therefore, they believe their memory has significantly deteriorated, even if objective tests show only slight changes or no changes at all.

Brain adaptations. Numerous studies have shown that women undergo numerous brain changes during pregnancy. The main changes include a decrease in gray matter volume and white matter density. Another study also confirmed that cortical thickness and gray matter volume in the subgenual and lateral prefrontal cortex do not return to prepregnancy levels even 12 weeks after birth.(Chechko & Nehls (2025))

These changes may be due to hormonal influences. Estrogen and progesterone have been found to influence dendritic spine density, dendritic length/arborization, and soma size in the hippocampus and medial preoptic area.

A study by Kim et al. (2016) showed that structural changes continue to occur in the woman's brain in the first months after birth. Increased volumes of brain regions associated with maternal behavior, emotional regulation, motivation, and the reward system were found. Changes were also observed in areas involved in sensory processing, empathy, and social interaction. These findings suggest that after birth, the mother's brain adapts to the new demands of caring for the infant and forming an emotional bond with the baby.

Studies have shown a link between the method of birth (vaginal or cesarean section) and brain changes. During vaginal birth, sensory stimulation leads to an increase in oxytocin and influences maternal behavior, while this does not occur during cesarean section. A 2007 fMRI study by Swain et al. demonstrated a link between the method of birth and a mother's response to her baby's cry.

The study found that in the early postpartum period, mothers who gave vaginal births demonstrated stronger activation in brain regions associated with maternal motivation, emotional attachment, and infant processing, compared to mothers who gave cesarean sections. Vaginal birth was associated with greater responses in sensory processing regions (superior and middle temporal gyri, fusiform gyrus, and thalamus) and cognitive and emotional control regions (superior frontal gyrus) compared to cesarean section. However, as mothers adjusted to motherhood, these differences gradually disappeared.

Postpartum depression. Postpartum depression is a serious problem that affects approximately 15-20 percent of pregnancies. Postpartum depression occurs in women within the first month after childbirth and can last up to a year. Symptoms of postpartum depression are similar to those of major depressive disorder, including diminished interest, depressed mood, insomnia, and others. Brummelte

& Galea (2015) The risk of developing postpartum depression is higher in women who experience financial difficulties, become mothers at a young age, belong to social minorities, or grew up in an environment where they received insufficient parental care or support. (Silverman et al. (2020)) Women with a history of major depression and impaired cortisol regulation are especially at risk of suffering from postpartum depression. Every year an average of 12% of women who give birth in developed countries suffer from postpartum depression.

This negatively impacts the mother, child, and family as a whole. Postpartum depression can lead to serious consequences, such as decreased breast milk supply, decreased attention to the child, sleep disturbances, and a deterioration in overall quality of life. Because postpartum depression is understudied, little is currently known about brain changes in women with postpartum depression. According to Pawluski, Lonstein, and Fleming (2017), the main changes in the brain of women with postpartum depression include weakened connectivity between the amygdala (AMG), anterior cingulate cortex (ACC), dorsolateral prefrontal cortex (DLPFC), and hippocampus compared to women without postpartum depression. These brain regions play an important role in self-regulation, empathy, emotion processing, and executive function. The brain network that regulates emotion functions less effectively. In women with postpartum depression, the brain responds differently to emotional cues. The main changes are associated with the amygdala, which is responsible for emotion processing. Research has also revealed altered connections between the amygdala and the insular cortex. This makes it more difficult for a woman to respond emotionally to what's happening and to enjoy interactions with her child. This also impacts the mother's sensitivity to the child's needs and the quality of maternal care for the infant. (Cheng et al. (2022))

A review of the literature revealed that cognitive changes in the postpartum period are typically minor. Despite frequent subjective complaints of memory loss, most studies do not reveal significant cognitive impairment in women after childbirth. However, structural and functional changes in the brain associated with maternal behavior, emotional regulation, and the formation of attachment to the child are observed in the postpartum period. Furthermore, postpartum depression is associated with changes in the brain networks responsible for emotional processing, self-regulation, and executive functions.

Discussion

The postpartum period is accompanied by significant neurobiological and psychological changes that can impact a woman's cognitive functioning. Available data suggest that changes in memory and other cognitive functions after childbirth are generally mild and do not lead to significant cognitive deficits. Adaptive changes in the brain contribute to the development of maternal behavior, while postpartum depression can negatively impact emotional state and cognitive processes. Further research is needed to more fully understand the mechanisms of cognitive changes during the period.

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