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Kangaroo care and postpartum depression: The role of oxytocin

Hanan A. Badr [a, b, *], Jaclene A. Zauszniewski [c]

[a] Case Western Reserve University, Frances Payne Bolton School of Nursing, 10900 Euclid Avenue, Cleveland, OH 44106-4904, USA
[b] King Abdul Aziz University, School of Nursing, Jeddah, P.O. Box 80200, 21589, Saudi Arabia
[c] Case Western Reserve University, Frances Payne Bolton School of Nursing, 2120 Cornell Road, Cleveland, OH 44106, USA

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ABSTRACT

Problem: Postpartum depression occurs in about 10–22% of women after birth and adversely affects their health and the health of their newborn. Kangaroo care is known to have many health-related benefits for both the mother and her newborn.
Purpose: The aim of this review was to gather the evidence linking the effects of kangaroo care with postpartum depression, specifically focusing on the proposed underlying mechanism involving the release of oxytocin.
Method: The literature review was conducted by targeting PubMed, CINAHL, and Google Scholar databases. The search terms used were postpartum depression, postnatal depression, oxytocin, oxytocin hormone, postpartum depression, kangaroo care, and skin-to-skin contact.
Results: Kangaroo care was found to play an important role in decreasing the risk for postpartum depression. Skin-to-skin contact during kangaroo care was found to trigger the release of oxytocin, which is hypothesized to minimize the risk for depressive symptoms as well as decrease maternal stress. The oxytocinergic system regulates the release of oxytocin, which is an effect that is opposite that which occurs with the human stress response, in which the sympathetic nervous system is activated to release catecholamines in response to harmful or threatening stimuli. The oxytocinergic system regulates calmness, connection, and socialization processes. During kangaroo care, oxytocin blocks the stress response and decreases the circulation of catecholamines, yielding positive outcomes that include maternal stress reduction and prevention of postpartum depression.
Conclusion: Kangaroo care can be used as a non-pharmacological intervention to prevent or decrease the risk of postpartum depression.

1. Introduction

Postpartum depression (PPD) is an ongoing problem, affecting about 10–15% of women after birth [1]. The prevalence, however, is changing over time; during the postpartum period [2], the prevalence of PPD at 6–8 weeks postpartum ranges from 13% to 22%, and 10% at 12 weeks postpartum [3–5]. At 6 months of the postpartum period, the range is from 13% to 19% [6]. PPD is one of the most critical problems encountered during the postpartum period, not only because of its adverse effect on the mother and the newborn's health [7–10], but because 20% of postpartum deaths occur due to suicide committed by the mother who was diagnosed with postpartum depression [11]. PPD negatively affects maternal-newborn interactions [9,12], the mother's social life and health [13].

Because the adverse outcomes of PPD are so profound, interventions and therapies have been sought to prevent or minimize PPD. An emerging therapy is skin-to-skin contact between the mother and her newborn, called kangaroo care (KC). The knowledge base relating KC to PPD treatment is still small, but growing. The paucity of literature linking KC with PPD may be contributing factor related to the limited use of KC by health care professionals [14].

In addition, a mechanism has been proposed by which KC may prevent or minimize the symptoms of PPD. It is likely that oxytocin, a hormone released into the bloodstream during childbirth and recently dubbed as the “cuddle chemical [15],” plays an intermediary role. The skin-to-skin contact provided during KC triggers the release of oxytocin, which may, in turn, minimize the new mother's

* Corresponding author. Case Western Reserve University, Frances Payne Bolton School of Nursing, 10900 Euclid Avenue, Cleveland, OH 44106-4904, USA.
E-mail addresses: hab42@case.edu, habadr@kau.edu.sa (H.A. Badr), jaz@case.edu (J.A. Zauszniewski).
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risk of experiencing depressive symptoms. Therefore, the purpose of this literature review is to provide support for the hypothesis that oxytocin released during KC may minimize PPD. The evidence for the link between KC and PPD begins with a discussion of PPD, its theoretical definitions, etiology, signs, and symptoms. Then there will be a review of KC's physiology and, specifically, its effect on oxytocin levels. Finally, a description of KC's previously investigated effects on PPD will be presented. The literature review was conducted by targeting PubMed, CINAHL, and Google Scholar databases. The search terms used were postpartum depression, postnatal depression, oxytocin, oxytocin hormone, postpartum depression, kangaroo care, and skin-to-skin contact.

2. Postpartum depression (PPD)

Birth may not be so joyful when PPD is taken into consideration. Giving birth and having a newborn are stressful life events for some women because giving birth to a newborn can lead to major physiological, psychological, cultural, spiritual, and emotional changes [9]. The American Psychological Association (APA) defined PPD as a serious mental health problem characterized by a prolonged period of emotional instability, occurring up to four weeks after birth; PPD results from the major life change and increased responsibilities that follow the care of a newborn infant [16].

The signs and symptoms of PPD include changes in sleeping and eating patterns, anxiety and insecurity, emotional instability, mental confusion, loss of self, feelings of guilt and shame, and suicidal thoughts [8,9]. Based on a study by Kammerer and colleagues, 43% of the mothers who have experienced PPD lost their appetite, 16% had insomnia, 71% felt energy loss and fatigue, 50% experienced decreased concentration, 26% had feelings of worthlessness and a lack of self-esteem, and 16% experienced suicidal ideation [17].

2.1. Predisposing factors to PPD

Several predisposing factors for PPD exist; some are maternal in nature, whereas others are infant-based factors. The maternal factors include any social or personally challenging circumstances that the mother may have faced before, during, or after labor, as well as the mother's psychological or biochemical changes before, during, and after birth. Infant factors include any medical conditions that require the newborn to receive special care [7,18,19].

Beck [7] conducted a meta-analysis of 44 studies to determine the predictors of PPD revealed in the literature. The following predictors were identified: prenatal depression, maternity blues, stress, social support, prenatal anxiety, marital dissatisfaction, history of depression, infant temperament, maternal self-esteem, socioeconomic status, marital status, unplanned or unwanted pregnancy, and childcare stress. Beck used the effect sizes from the studies she reviewed to determine the strength of the link between each predictor and PPD. The effect sizes were set at 0.2 to represent a small relationship, 0.4 to indicate a medium relationship, and 0.8 for a strong relationship. The meta-analysis showed that the predictors with a small effect size were socioeconomic status, marital status, and unplanned or unwanted pregnancy. Most of the other predictors had a medium effect size; prenatal depression had the strongest effect size ($d = 0.75$). This finding indicates that mothers who have a history of prenatal depression are at higher risk of developing postpartum depression.

Another study was conducted on 12,361 women who completed Edinburgh Postnatal Depression Scale (EPDS), wherein they were screened for the psychosocial factors that can lead to depression by using a self-report psychosocial risk factor questionnaire (PSRFQ). The results showed that 925 (7.5%) of the mothers had postpartum depression because they scored more than 12 in the EPDS. The strongest risk factors for postpartum depression found among this population were: a previous history of depression and low social support [20]. Furthermore, Roomruangwong, Withayavanitchai, and Maes found similar results when they conducted their study on 53 postpartum women who had high levels of depression at 4–6 weeks postpartum [21].

Moreover, Dennis, Janssen, and Singer conducted a longitudinal study on 594 women at 1and 8 weeks during their postpartum period in Vancouver, British Columbia. The risk factors they analyzed were sociodemographic factors, biological factors, pregnancy-related factors, life stressors, social support, obstetric factors, and adjustment to motherhood. The results of their study showed that 29.4% of the mothers had PPD at 1 week, and at 8 weeks the rate was 20.2%. The strongest predictors of postpartum depression found in their study were: history of depression, stressful life events, lack of perceived support, lack of readiness for hospital discharge, and dissatisfaction with infant feeding [22]. Eberhard-Gran, Eskild, Tambs, Samuelsen, and Opjordsmoen found similar results in their study. In addition to the history of depression and lack of social support, these researchers found that mothers who did not breastfeed their newborns and first-time mothers had higher depression scores [23].

2.2. Negative effects of PPD

PPD has several negative effects on infants, such as altered growth, greater risk of fussiness, less interaction with their mothers, and difficulties with sleeping and eating; separation problems have been found to occur later in life [24].

Surkan and colleagues [10] performed a prospective longitudinal study on 6550 singleton births followed from birth through 6 years of age and classified these according to the level of maternal depression. Mothers with moderate or severe PPD had children of shorter stature in their first 6 years of life than mothers who did not have PPD. Negative effects on maternal–infant interactions have been documented as well. Depressed mothers often experience less visual and focal communication with their newborns than non-depressed mothers [25–27]. Also, Beck [13] conducted a meta-analysis of 19 studies to examine the effects of PPD on mother–infant interactions. The results showed that PPD had medium to large negative effects on mother–infant interactions during the first year of birth. Beck explained that if the mother is emotionally unstable, the dyad interaction between a mother and her newborn is unlikely to occur.

In addition, PPD negatively affected breastfeeding and infant weight. Gaffney, Kitsantas, Brito, and Swamidoss conducted a study on 1447 mother–infant dyads and found that the mothers who had PPD breastfed their infants less frequently than mothers without PPD; these mothers also added cereal to the infant formula earlier, which led to an increased risk for being overweight among these infants [28]. Moreover, the researchers reported that infants of the depressed mothers were admitted to hospitals and visited emergency rooms more frequently during the first year than those infants born to non-depressed mothers. Infants with depressed mothers also had fewer checkup visits during the first 2 years of the child's life when compared to the infants or non-depressed mothers [29].

2.3. Strategies to treat postpartum depression

Several strategies are used to treat PPD, including pharmacological and non-pharmacological interventions [30]. Regarding pharmacological interventions, few studies have measured the effectiveness of pharmacological treatment in mothers diagnosed

with PPD [31]. In addition, even though only small amounts of antidepressant medications are secreted in breastmilk, there is insufficient research to show whether this is safe for newborns [31]. Therefore, most mothers are reluctant to take pharmacological treatments and see non-pharmacological treatments as more acceptable [30].

The non-pharmacological interventions for PPD include listening visits (a form of intervention started in Britain that focuses on the mother's experience with her child, particularly if the mother is facing problems in taking care of her newborn [6]); cognitive behavioral therapy (CBT) that focuses on helping depressed mothers modify their negative thoughts by changing their behaviors to improve their ability to cope and reduce stress [32]; interpersonal therapy, psychoeducation, psycho-supportive therapy [30], and KC [33]. The meta-analyses done by Cuijpers, Brännmark, and van Straten [34] found that psychological interventions had small effects in treating PPD, whereas numerous studies have shown that KC has a positive effect on decreasing the severity of PPD and in preventing PPD in its early stages [2,35,36].

3. The effect of KC on postpartum depression

3.1. Kangaroo care (KC)

Kangaroo care is the placement of the newborn infant, who is wearing only a diaper, against the mother's skin, chest-to-chest, after birth, and it includes continuous breastfeeding that should be performed in a specific position for a specific period of time. The safest position for the newborn is an upright position. Correct positioning is crucial because unsafe positioning might lead to sudden infant death [37]. The recommended duration for KC is from a minimum of 10 min to a maximum of 24 h per day, every day [37].

3.2. Positive effect of kangaroo care on PPD and maternal mood

Regarding the effect of KC on PPD and the maternal stress level, Bigelow, Power, MacLellan-Peters, Alex, and McDonald [2] studied the effect of KC on mothers with PPD during the first 3 postpartum months and the mothers' physiological stress during the first postpartum month. The results showed that mothers in the KC group had lower scores for depression during the first month postpartum. In addition, the salivary cortisol level was lower among the mothers in the KC group. Athanasopoulou [33] also performed a systematic review to see if KC could improve the mother's mood and decrease the risk of developing PPD. The results showed that even though the findings of the studies they reviewed were inconclusive, there was some evidence to suggest that KC can make a positive difference in these areas. Specifically, it was found that KC can improve negative maternal mood (e.g., anxiety, depression) and promote more positive parent–child interactions.

Moreover, de Macedo, Cruvinel, Lukasova, and D'Antino [36] compared the mood variation of mothers who provided KC to their newborns to the mothers who had their newborns in the incubator and were not in direct contact with them. There were 90 mothers enrolled in this study who were divided into three groups. Of the 90 mothers, 30 mothers of full-term babies provided KC, 30 mothers of preterm babies provided KC, and 30 mothers of preterm infants had their babies placed in incubators. The researchers measured the mothers' mood before and after the newborns' arrival and compared the results across the groups. The results showed that mothers of full-term babies experienced a less depressive state than the mothers who had preterm infants in general; however, there was a significant mood variation between the mothers who provided KC to their newborns and those whose babies were placed in incubators. The group of KC mothers reported that they felt calmer, stronger, more coordinated, energetic, contented, relaxed, proficient, happy, friendly, and clearheaded.

In addition, de Alencar, Arraes, de Albuquerque, and Alves [38] performed a prospective study to assess the relationship between KC and PPD among low-income mothers. This study showed that there was a decrease in the depression score among mothers who provided KC. In addition to that, Ahn, Lee, and Shin [35] studied the effects of KC on both premature infants and their mothers. They measured PPD and the results showed a decrease in the PPD scores of the mothers in the KC group when compared with a group that did not use KC.

KC has also been the subject of a number of case studies and the results showed that KC was effective in decreasing PPD. Burkhammer and Anderson conducted a case study for a young mother whose first pregnancy had ended in stillbirth due to eclampsia. When she became pregnant with her second child, she was afraid of losing her newborn for a second time. After she gave birth to her second newborn, she experienced stress, anxiousness, and bouts of crying. The clinician helped the mother engage in immediate skin-to-skin contact with her newborn. During skin-to-skin contact, the mother stopped crying, felt more relaxed, and started to breastfeed her baby [39]. Another case study also showed the same result; in this case study, the mother was in rehabilitation for drug abuse and, after she gave birth to her newborn, she cried for more than 2 h; her depression score was also high. However, after she provided KC for the first time for her newborn, she felt calmer, and her PPD score decreased significantly [40].

In summary, the results of the above studies show the positive effects of KC in decreasing PPD among mothers who had diverse experiences with PPD. In fact, the explanation for these positive effects of KC on PPD has been provided in the literature as being associated with the effect of hormonal secretions of oxytocin that occurs during KC [41–43].

4. Oxytocin hormone as a factor affecting PPD

4.1. Oxytocin hormone

Oxytocin is composed of nine amino acid peptides that have a highly conserved chemical structure across many mammalian species. Oxytocin has several effects on a mother's body both during and after labor. It causes uterine contractions during labor and leads to the let-down reflex during breastfeeding [44,45]. Oxytocin is one of the four so-called “happy chemicals,” or hormones, found in the human body. It plays an important role in facilitating bonding and trust between newborns and their mothers [46]. Oxytocin has both peripheral and central effects; the peripheral effects occur when oxytocin is released into the blood stream, provoking uterine contractions during labor and milk ejection during breastfeeding. The central effects of oxytocin are also linked to sexual and reproductive stimuli, as well as to nonsexual stimuli. These sexual reproductive stimuli affect genital and breast stimulation, as well as birth, suckling, and sexual intercourse. The nonsexual stimuli include behaviors such as grooming [47]. Oxytocin is associated more strongly with female rather than male gender because oxytocin reception is related to the hormone estrogen [48].

4.2. How KC works on oxytocin

The effects of KC on PPD can be physiologically explained by the endocrine effects of oxytocin released in the brain and in circulation in the hypothalamic-pituitary-adrenal axis during KC. The oxytocinergic system regulates the release of oxytocin [49]. Oxytocin is synthesized in the hypothalamus and then released and stored in the posterior pituitary [50]. The oxytocinergic system and

the stress system (fight-or-flight) have opposite effects on the systems of human beings. Fight-or-flight behavioral responses are anxiety, aggression, increased cardiovascular activity, and elevated blood glucose levels. Also, the stress system works by activating the sympathetic nervous system, which releases the catecholamines epinephrine and norepinephrine in response to demanding, harmful, or threatening stimulants [51–53].

The oxytocinergic system also regulates the calmness, connection, and socialization processes. During KC, oxytocin is released, which works to shut off the stress systems upon reaching the amygdala. Oxytocin also stimulates maternal behaviors, such as attachment, and can have anxiolytic, sedative effects and increase one's pain threshold. Moreover, oxytocin has antidepressant-like properties. Oxytocin can help decrease the circulation of catecholamines in the mother, which is considered a positive outcome of hormonal oxytocin because it reduces maternal stress [52–54].

4.3. The effect of oxytocin on postpartum depression

Oxytocin has been shown to play a role in the initiation of maternal affiliated behavior and maternal-infant interaction and to positively affect the mother's mood. In animal studies, Winslow, Noble, Lyons, Sterk, and Insel found that monkeys separated from their mothers immediately after birth had a syndrome characterized by decreased affiliation, increased aggression, and increased self-directed, repetitive behavior. This syndrome resulted from decreased levels of cerebrospinal fluids of oxytocin through 36 months of age [55].

In human studies, researchers found a correlation between a decrease in anxiety and the triggering of good feelings during the postpartum period because oxytocin levels increase in the cerebrospinal fluid during KC [56]. Also, Stuebe, Grewen, and Meltzer-Brody [52] looked at maternal depression, anxiety symptoms, and their association with shorter breastfeeding periods, as well as their effect on the neuroendocrine response to infant feeding. The results showed that increased oxytocin levels led to a decrease in maternal depression and anxiety symptoms. Another study was done on 74 healthy pregnant women to assess the association between plasma oxytocin (OXT) during pregnancy and the development of PPD symptoms. The results showed that the women who had lower levels of plasma OXT during pregnancy had higher levels of PPD two weeks after they gave birth [57]. Several other studies have measured the association between oxytocin levels and maternal behavior in various situations. The results of these studies showed that peripheral oxytocin is released during KC and during breastfeeding, which can lead to an increased level of maternal response to the baby and increased bonding, while decreasing the mother's stress level [41–43].

5. Conclusion

In this literature review, various studies related to PPD, KC, the oxytocin hormone, and the relationships between such concepts were discussed. Consistently, KC has been associated with positive effect in preventing PPD and in decreasing the risk of mothers for developing PPD. The physiological explanation of this effect is that the oxytocin hormone is released during KC. Based on this information, the review of literature suggests that KC can be used as a non-pharmacological intervention to prevent PPD or to decrease the risk of developing PPD. Thus, mothers at risk for developing PPD should be encouraged to use KC.

There have been very few studies on the effect of KC on the mother's psychological status during the postpartum period. To study this, future studies will need to focus on the benefits of KC for the mother and explore the effect of oxytocin during KC on the mother's psychological health during the postpartum period.

Author contribution

The first author, Hanan A. Badr, performed the literature search, organized the results and drafted the manuscript. Dr. Jaclene A. Zauszniewski assisted in critically revising the manuscript for important intellectual content. Both authors approved the final version to be submitted to the journal.

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Appendix A. Supplementary data

Supplementary data related to this article can be found at http://dx.doi.org/10.1016/j.ijnss.2017.01.001.

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