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Breastfeeding as a Natural Therapy for Anxiety: A Study of Heart Rate Variability in Breastfeeding Mothers

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ABSTRACT

Perinatal mental health issues, particularly postpartum anxiety, are a global concern with significant impacts on maternal well-being and child development. Heart Rate Variability (HRV), reflecting autonomic nervous system balance, is a useful indicator of stress and anxiety. Breastfeeding is known to enhance HRV and reduce anxiety via oxytocin release. This study aimed to assess the effectiveness of breastfeeding using an oxytocin carrier in reducing anxiety among breastfeeding mothers, measured through HRV. A quasi-experimental, cross-sectional design was used, involving 120 breastfeeding mothers purposively sampled from communities in the Special Region of Yogyakarta. The intervention involved applying an oxytocin carrier for 15–20 minutes, twice daily for three days. HRV and anxiety levels were measured pre- and post-intervention using standard laboratory instruments and validated questionnaires. Results showed a significant effect ($p = 0.000 < 0.05$), indicating that breastfeeding interventions with an oxytocin carrier effectively reduced maternal anxiety and improved HRV in both mothers and infants. This approach supports maternal mental health, breastfeeding success, and strengthens the physiological bond between mother and infant. It is recommended to integrate breastfeeding education highlighting its benefits for autonomic balance, anxiety reduction, and overall maternal-infant well-being.

Keywords
Anxiety
Breastfeeding Mothers
Heart Rate Variability
Natural Therapy

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Introduction

Perinatal mental health issues are a growing global concern, including in Indonesia. Data from the 2018 Basic Health Research reveals that the prevalence of emotional mental disorders, characterized by anxiety and depression symptoms, reached 9.8%, with higher rates observed in women of reproductive age [1]. Postpartum mothers often experience symptoms such as mood disorders, anxiety, mood swings, and sleep problems [2]. Postpartum anxiety, a significant challenge for breastfeeding mothers, has a global prevalence reaching 15%. Additionally, about 12% of women experience depression during pregnancy [3]. Hormonal shifts, altered sleep patterns, and the demands of infant care contribute to increased psychological stress. If left untreated, this stress can negatively impact mother-child interactions and the child's overall development [4].

Maternal postpartum mental health can be objectively assessed through heart rate variability (HRV), which reflects the balance of the autonomic nervous system. Lower HRV is often linked to increased stress, anxiety, and depression [5]. Research indicates that mothers with low HRV are more vulnerable to mental health disorders and tend to have infants with lower HRV [6]. Thus, HRV serves as a physiological parameter for evaluating maternal mental well-being postpartum.

Breastfeeding is known to alleviate postpartum anxiety and enhance maternal mental well-being. Oxytocin, a hormone released during breastfeeding, provides a calming effect and helps reduce stress responses [7]. Studies indicate that breastfeeding mothers have a lower risk of postpartum depression compared to non-breastfeeding mothers [8]. Moreover, breastfeeding is linked to increased HRV, suggesting its role in maintaining autonomic nervous system balance and reducing physiological stress [6]. While HRV can increase during stress [9], innovations such as breastfeeding while babywearing offer additional benefits to maternal mental health. Holding the baby in an ergonomic carrier enhances comfort for both mother and baby, boosts oxytocin production, and extends skin-to-skin contact [10]. Research suggests that using a baby carrier can increase breastfeeding frequency, contributing to improved HRV and maternal emotional well-being [11]. Conversely, breastfeeding mothers facing significant obstacles and challenges are at a higher risk of mental health symptoms [12].

This study aims to investigate the role of breastfeeding in reducing anxiety, using HRV as an objective indicator. Given the limited research on the combined effectiveness of breastfeeding and babywearing on maternal mental health, particularly within the Indonesian population, our findings are expected to provide new insights for breastfeeding promotion efforts, raise awareness about the importance of maternal mental health during lactation, and inform relevant health policies.

Material and Methods

This study employed a quasi-experimental design with a pre-post test approach without a control group. The study was conducted within a breastfeeding mother community in the Special Region of Yogyakarta. This community receives support from primary health services, including lactation education and breastfeeding promotion. Postpartum anxiety was identified as a key intervention focus in this community due to its potential to disrupt breastfeeding continuity.

While this setting offers a unique opportunity to assess community-based interventions, the cultural and healthcare context of Yogyakarta-where breastfeeding support is integrated into primary health services-may not fully represent other regions in Indonesia or globally. Cultural beliefs surrounding postpartum care, varying access to health services, and socioeconomic status might influence maternal anxiety and responsiveness to interventions. Therefore, the generalizability of these findings to other populations should be interpreted with caution. Future studies in diverse geographic and cultural contexts are recommended to strengthen external validity.

The target population was all breastfeeding mothers in Yogyakarta Special Region, with a total of 172 people. A sample of 120 respondents was determined using the Slovin formula with a 5% error rate, and was selected by purposive sampling based on inclusion criteria. These criteria included: breastfeeding mothers with children aged <2 years, maternal age 20–35 years, healthy physical condition, normal Body Mass Index (BMI) (18.5–24.9), no history of cancer or breast surgery, and not taking medications that affect breastfeeding. Mothers with medical conditions that affect breast milk production or babies with extreme weights were excluded from the sample.

The intervention was the use of an ergonomic oxytocin carrier with an electromassage feature, used for 15–20 minutes, twice a day for three consecutive days. This carrier is designed to provide oxytocin stimulation through gentle pressure on the mother's back and has been validated through expert judgment by an anatomist-physiologist. Data were collected through HRV measurements before and after the intervention using a standardized portable electrocardiography device, as well as a validated anxiety questionnaire. Data collection was carried out by professional midwives and laboratory personnel who had undergone training. This study has obtained ethical approval from the Ethics Committee of Universitas 'Aisyiyah Yogyakarta (No. 3753/KEP-UNISA/VI/2024). All participants signed an informed consent form after receiving a complete explanation of the objectives, procedures, benefits, and potential risks of the study. Data analysis was performed using IBM SPSS version 26 software. The Wilcoxon Signed-Rank Test statistical test was used to evaluate differences in HRV levels and anxiety levels before and after the intervention.

However, the absence of a control group is a key limitation that affects the internal validity of the study. Without a comparison group, it is difficult to fully isolate the effects of the intervention from other potential influences such as natural recovery, placebo effects, or external psychosocial factors. Although quasi-experimental designs are appropriate in exploratory settings, future research should consider incorporating a randomized controlled trial (RCT) to strengthen causal inferences and minimize bias

Results

A. Respondent Characteristics

Table 1. Respondent characteristics.

Variable	Category/Interval	Frequency (f)	Percentage (%)
Infant's age	1–3 months	4	3.3
	3–6 months	16	13.3
	6–12 months	80	66.7
	12–18 months	16	13.3
	18–24 months	0	0
	24–30 months	0	0
	>3 years	4	3.3
	Total	120	100
Mother's age	22–25 years	12	10
	25–30 years	36	30
	30–35 years	52	43.3
	35–40 years	12	10
	40–45 years	8	6.7
	Total	120	100
Mother's occupation	Private employee	20	16.7
	Housewife	100	83.3
	Total	120	100
Mother's weight	40–45 kg	4	3.3
	45–50 kg	16	13.3
	50–55 kg	16	13.3
	55–60 kg	32	26.7
	60–65 kg	24	20
	65–70 kg	12	10
	70–75 kg	4	3.3
	75–80 kg	12	10
	Total	120	100

Source: Primary data collected in 2024

Based on the characteristics of the respondents in this study (Table 1), the majority of infants were in the age range of 6–12 months (66.7%), which is an important phase in

breastfeeding and forming an emotional attachment to the mother. Most mothers were between 25–35 years old (73.3%), included as an active reproductive age and generally still breastfeeding. In terms of type of occupations, the majority of respondents were housewives as much as 83.3%, which allowed them to have more flexible time to breastfeed and carried out direct care practices such as carrying babies. In terms of weight, most mothers weighed between 55–65 kg (46.7%), which reflects a relatively normal and healthy physical condition to support breastfeeding activities. These data indicate that the population in the study has relevant characteristics and supports evaluating the effectiveness of breastfeeding interventions with oxytocin carriers on the physiological well-being of mothers and babies.

B. Statistical Test Analysis

Table 2. Average HRV levels before and after carrying intervention.

Variable	Results	N	Min	Max	Mean ± SD
Infant's HRV	Pre-Test	120	72	132	92.37 ± 15.26
Infant's HRV	Post-Test	120	82	154	106.6 ± 14.36
Mother's HRV	Pre-Test	120	74	99	86.57 ± 7.18
Mother's HRV	Post-Test	120	75	100	91.67 ± 6.74

Source: Primary data collected in 2024

The results of this study indicate that intervention in the form of breastfeeding using an oxytocin carrier has a significant impact on increasing HRV in mothers and babies. Based on Table 2, the average HRV of mothers increased from 86.57 (pre-test) to 91.67 (post-test), while the infant's HRV increased from 92.37 to 106.6.

This increase in HRV indicates that carrying a baby can contribute to reducing anxiety levels and increasing relaxation in mothers. Breastfeeding and carrying a baby can reduce maternal anxiety, thereby increasing the balance between the mother's sympathetic and parasympathetic nervous systems.

Table 3. Effect of carrying intervention on HRV levels.

Variable	Group	N	Mean	Std. Dev	p-value
Infant's HRV	Pretest	120	92.37	15.26	0.000*
Infant's HRV	Posttest	120	106.6	14.36	
Mother's HRV	Pretest	120	85.67	7.18	0.000*
Mother's HRV	Posttest	120	91.67	6.74	

Source: Primary data collected in 2024

Statistical tests using the Wilcoxon Signed-Rank Test in Table 3 show a p-value of 0.000 for HRV in both mothers and infants, which means that there is a significant effect of the carrying intervention on changes in HRV. This increase in HRV is in line with the finding

that breastfeeding and carrying activities can increase the release of oxytocin and reduce cortisol levels, thus affecting the physiological stability and emotional well-being of mothers and babies.

Discussions

This study demonstrates that breastfeeding intervention using an oxytocin carrier positively impacts HRV. HRV is a physiological indicator of autonomic nervous system balance, specifically reflecting increased parasympathetic activity. A higher HRV suggests an improved capacity to adapt to stressors, closely linked to decreased anxiety and enhanced emotional regulation. Physiologically, breastfeeding stimulates oxytocin release, a hormone that reduces stress responses via parasympathetic nervous system activation. The ergonomic carrier not only supports optimal breastfeeding positions but also enhances maternal comfort, extending skin-to-skin contact. This contact increases oxytocin levels, decreases cortisol, and improves physiological stress responses, including HRV [7]. These findings indicate the significant potential of babywearing as a non-pharmacological intervention to support maternal postpartum mental and physical health. By integrating babywearing practices into maternal and child health programs, we can create a more supportive environment for mothers to breastfeed effectively and manage stress.

Skin-to-skin contact during carrying and breastfeeding has been shown to increase oxytocin levels, stimulating the parasympathetic nervous system and reducing stress responses [13]. Increased HRV further illustrates the physiological synchronization between mother and infant, strengthening emotional bonds and neurophysiological stability [14]. Recent studies also support that babywearing can enhance physiological co-regulation between mother and infant, as evidenced by synchronized heart rates and breathing patterns, contributing to the healthy development of the infant's stress regulation system [15].

Subjectively reported decreases in maternal anxiety, assessed via the DASS-21 scale, are consistent with this HRV increase, supporting HRV as an effective biomarker for emotional and stress regulation [15] [16]. Thus, breastfeeding with an ergonomic carrier offers both physiological and psychological benefits, particularly in supporting mothers' emotional transition postpartum. This intervention shows significant potential as a non-pharmacological approach to support maternal postpartum mental and physical health, suggesting its integration into maternal and child health programs could foster a more supportive environment for effective breastfeeding and stress management.

This study demonstrates that breastfeeding intervention using an oxytocin carrier positively impacts HRV, a physiological indicator of autonomic nervous system balance. Higher

HRV reflects an improved capacity to adapt to stressors, closely linked to decreased anxiety and enhanced emotional regulation [17] .

The main mechanism of this intervention lies in this skin-to-skin contact and physical proximity during breastfeeding in a carrier, which activates the parasympathetic nervous system in both dyads. Previous studies have shown that skin-to-skin contact increases HRV in premature infants, indicating improved autonomic regulation and reduced stress [13]. Breastfeeding consistently enhances autonomic nervous system balance, with significant high-frequency (HF) increases in HRV (reflecting parasympathetic activity) observed in actively breastfeeding mothers [18]. This is further supported by [19], who found that babywearing mothers reported lower stress and improved mother-infant interaction quality, correlating positively with increased HRV in the dyad.

Moreover, breastfeeding in a carrier strengthens mother-infant heart rate co-regulation. Observational studies show heart rhythm synchronization when infants are in an ergonomic carrier position, contributing to dyadic emotional and physiological stability [14]. The anxiety reduction experienced by mothers during carrier-supported breastfeeding interventions is thus closely linked to the observed HRV increase. HRV-based interventions, such as biofeedback, effectively reduce anxiety symptoms, including during pregnancy and postpartum [16]. Therefore, the increase in HRV as a result of breastfeeding with a carrier can contribute significantly to reducing maternal anxiety.

A key policy implication of these findings is the importance of promoting babywearing within breastfeeding counseling in primary healthcare settings, such as community health centers or birthing clinics. Healthcare providers can offer education and demonstrations on safe and ergonomic carrier use to support proper breastfeeding positions and facilitate continuous skin-to-skin contact. A study by [20] highlights that support from healthcare professionals in promoting babywearing significantly increases the adoption rates of this practice among new mothers.

Factors such as maternal age, BMI, and physical activity do affect HRV. However, in this study, these variables were controlled to ensure that the observed changes in HRV were truly the result of the intervention given. This study confirms the importance of the oxytocin carrier as an innovation in supporting exclusive breastfeeding practices. In addition to facilitating an ergonomic and comfortable breastfeeding position, this carrier also helps extend the duration of physical contact between mother and baby, which is essential in enhancing the positive physiological effects of breastfeeding. A study by [21] stated that longer breastfeeding duration was positively correlated with increased vagal activity and infant stress regulation.

Given the widespread benefits of babywearing, governments and health agencies should develop clear guidelines and educational materials on the benefits and proper use of

carriers. This can be integrated into antenatal and postnatal programs, ensuring that mothers receive accurate information and necessary support. Research indicates that babywearing recommended and taught by healthcare professionals in primary settings leads to higher compliance rates and better breastfeeding outcomes [20].

The majority of studies on maternal heart rate variability (mHRV) have been conducted during pregnancy. Due to their undeveloped stress response system at birth, infants rely heavily on their mothers to manage their stress. Changes in newborn physiology, such as variability (HRV) and neural activity, can be brought on by variable stressors from mothers or caretakers. Mothers who have decreased mHRV also report far higher anxiety and depression levels. mHRV is highly correlated with maternal age, resting heart rate, maternal education, and income-to-needs ratio [24]. revealed higher self-reported maternal anxiety and depression were linked to reduced maternal HRV. Furthermore, babies born to mothers with lower HRV also had lower HRV [23]. In this study, we assessed the association between mHRV and newborn health as well as mHRV and maternal mental health.

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In this study, we assessed the association between mHRV and newborn health as well as mHRV and maternal mental health. The analysis shows physiological synchrony that strengthened the relationship between mHRV and infant neurologic function through infant HRV. Maternal well-being in infant development is very important [25] [26]. Higher mHRV correlated with lower levels of depression and anxiety, but not with perceived stress because respondents' environmental stress management and psychological distress differed [27] [28].

mHRV and perceived stress levels align with findings from prior studies [29]. A reduction in prenatal HRV has been linked to a heightened risk of developing anxiety disorders during late stages of pregnancy. Collectively, these observations contribute to the existing body of literature that connects physiological stress markers with mental health outcomes [30]. Similarly, this evidence reinforces earlier research indicating variations in HRV responsiveness and regulation during mother-infant interactions, depending on the presence of anxiety and depressive symptoms.

Oxytocin significantly contributes to the process of milk ejection during lactation and is recognized for its anxiolytic properties, partly due to its activation of the parasympathetic nervous system [7]. However, it is important to note that oxytocin is not strictly required for breastfeeding behavior itself [31]. Some studies propose that the act of an infant suckling stimulates the mother's vagus nerve, which in turn triggers nipple stimulation. Interestingly, maternal oxytocin levels have been shown to rise upon hearing an infant's cry an effect that occurs even before breastfeeding begins [32].

The duration of breastfeeding has been found to be closely linked with maternal mental health. According to findings by [21], extended breastfeeding is associated with enhanced vagal adaptability in both mothers and infants during their interactions, which elicits more positive physiological responses. Regular breastfeeding practices also contribute to improved vagal regulation in infants [21]. Initiating breastfeeding during the early postpartum period not only facilitates the recovery of maternal reproductive organs but also enhances neonatal immune function, offering protection against infections and allergies. This early initiation is associated with a natural hormonal surge that helps reduce maternal anxiety levels, which in turn can promote the continuation of exclusive breastfeeding by the first month postpartum. These findings highlight the importance of early breastfeeding as a critical factor for breastfeeding success, aligning with recommendations from the World Health Organization (WHO) [33]. Moreover, breast milk provides significant health advantages, particularly for infants with very low birth weight (VLBW)[34]. It has also been associated with improved neurodevelopmental outcomes in children who received breast milk during infancy [35]. There is a relationship between depression in breastfeeding mothers, especially in non-exclusive breastfeeding conditions and shorter breastfeeding duration. There is a positive relationship between maternal stress (perceived stress, anxiety, and/or depression) with suboptimal breastfeeding outcomes [36] [37], [38], [39].

These findings collectively support the need for health policies that actively support mothers in breastfeeding and babywearing practices. This could include training for nurses and midwives to teach safe babywearing techniques and ergonomic breastfeeding positions using carriers. Suggest that comprehensive training for healthcare professionals in lactation management and babywearing support can increase exclusive breastfeeding success rates and reduce the incidence of postpartum depression.

In conclusion, the results of this study revealed that breastfeeding intervention using oxytocin carriers had a significant positive impact on increasing HRV in postpartum mothers, which reflects an increase in the balance of the autonomic nervous system, especially the dominance of parasympathetic activity. Higher HRV is associated with decreased anxiety and increased emotional regulation in mothers. Physical interaction that occurs through skin-to-

skin contact during breastfeeding with a carrier not only improves the quality of the breastfeeding experience, but also supports the physiological and emotional stability of the mother and baby. By considering the physiological and psychological factors involved, this intervention can be an important innovation in supporting the mental and physical health of mothers, while strengthening the emotional bond between mother and baby. This study provides evidence that breastfeeding with oxytocin carriers can be an effective solution in improving the well-being of postpartum mothers and supporting the success of exclusive breastfeeding.

Based on these findings, we recommend the integration of babywearing promotion programs and education on proper carrier use that supports correct breastfeeding positions into healthcare professional curricula, as well as public health programs at the primary level. This aligns with WHO recommendations for optimal breastfeeding practices and can contribute to a reduction in the burden of postpartum anxiety. Emphasize that the implementation of proactive health policies supporting breastfeeding and babywearing practices has the potential to significantly improve maternal and child health outcomes at a population scale [40].

Conclusion

This study shows that breastfeeding intervention using oxytocin carriers significantly contributes to increasing HRV in mothers and infants, reflecting an increase in the balance of the autonomic nervous system, especially parasympathetic activity. The increase in maternal HRV from an average of 86.57 to 91.67 and infant HRV from 92.37 to 106.6 after the intervention, with a significance value of $p < 0.001$, strengthens the evidence that breastfeeding practices while carrying ergonomically can reduce stress, increase relaxation, and support emotional regulation.

These results are supported by the relevant characteristics of the respondents, namely the majority of mothers are of active reproductive age (25–35 years) and are housewives, allowing direct involvement in parenting practices. From a public health perspective, this intervention offers a simple yet evidence-based approach to supporting postpartum maternal well-being, preventing anxiety disorders, and increasing the success of exclusive breastfeeding. Therefore, the use of oxytocin carriers is worth considering as part of a promotive-preventive strategy in maternal and child health programs, especially during the postpartum transition period.

Conflict of Interest

The authors confirm that there are no conflicts of interest related to the publication of this study.

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