Original Article

The Effectiveness of Neuro-linguistic Programming Intervention in Enhancing Breast Milk Production, Reducing Stress Levels, and Improving Emotional Wellbeing among Breastfeeding Mothers: Quasi-experimental Study

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Abstract

Background: Breastfeeding is essential for infant health, yet many mothers face difficulties in milk production, often linked to psychological stress. Neuro-Linguistic Programming (NLP) is a psychological method that may improve emotional wellbeing and lactation outcomes. **Materials and Methods:** A quasi-experimental study was conducted in Sorong, Southwest Papua (March–April 2024), involving 70 breastfeeding mothers with infants aged 0–6 months. Participants were randomly assigned to an intervention group (n = 35), which received a 4-week NLP program, or a control group (n = 35), which received standard breastfeeding education. Each NLP session lasted 60 minutes weekly. Outcomes included daily breast milk volume (measured with calibrated cups), stress (Perceived Stress Scale, PSS), and emotional wellbeing (maternal self-confidence, emotion regulation, and marital satisfaction). Assessments were conducted at baseline, immediately post intervention, and 1 month later. **Results:** The intervention group showed a significant increase in milk production (from 450 ml to 600 ml/day; $p < 0.05$), while the control group remained stable. Stress scores declined in the intervention group (PSS: 22.4 to 14.5), with minimal change in the control group. Emotional wellbeing improved significantly across all domains in the intervention group compared to controls ($p < 0.05$). **Conclusions:** NLP significantly enhances emotional wellbeing and milk production among breastfeeding mothers. These findings support incorporating NLP-based psychological strategies into maternal health programs, particularly in high-stress or low-resource settings. Further research with larger and more diverse populations is recommended.

Keywords: *Breast milk production, breastfeeding mothers, emotional wellbeing, neuro-linguistic programming, perceived stress scale*

Introduction

Exclusive Breastfeeding (EBF) is defined as the provision of breast milk as the sole source of nutrition for an infant, excluding other liquids or solid foods except for prescribed medications, vitamins, or oral rehydration solutions, in line with global health guidelines.[1–3] During the first 6 months of life, EBF plays a crucial role in ensuring optimal infant growth and development. It strengthens the immune system and protects against infectious diseases.[4–12]

Moreover, breast milk contributes to cognitive and emotional development, especially during the early months of life.[13–16] However, despite these benefits, global and regional data show persistent challenges. In Indonesia's Southwest Papua region, only 41.3% of infants aged 6–23 months are exclusively breastfed—well below the national target of 70%, according to the 2023 Indonesian Health Survey (SKI).[17] While 79.3% of mothers initiate breastfeeding within 60 minutes postdelivery, just 4.6% meet the new Early Initiation of Breastfeeding (IMD) standards. These gaps highlight the urgent need for targeted interventions that address complex sociocultural and psychological factors. Psychological stress, anxiety, social pressure, and inadequate support are major barriers to successful breastfeeding.[4,18–21] In regions like Southwest Papua, the societal expectation of women as primary

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caregivers, compounded by economic hardship and limited healthcare access, exacerbates these emotional stressors, leading to reduced milk production and lower breastfeeding success.[22,23] Despite growing evidence that emotional support can enhance breastfeeding outcomes, there is a lack of research on targeted psychological interventions within diverse cultural contexts. Neuro-Linguistic Programming (NLP) is a promising approach aimed at modifying cognitive patterns, behaviors, and emotional responses.[30–32]

Nonetheless, the effectiveness of NLP in maternal health remains underexplored. While beneficial in therapeutic settings, NLP depends heavily on individual responsiveness and skilled facilitation. It may not address physiological causes of low milk supply and should be seen as complementary to clinical support. Given the sociocultural stressors in Papua, NLP could serve as a culturally adaptable strategy for emotional reinforcement. This study aims to evaluate the effectiveness of NLP in improving breast milk production, reducing maternal stress, and enhancing emotional wellbeing among breastfeeding mothers in Southwest Papua. It fills a critical gap by exploring a psychological intervention that may support broader maternal health initiatives.

Materials and Methods

This study employed a quasi-experimental design using a pre- and post-test approach to assess the effects of NLP on breastfeeding outcomes. The study was conducted over a 4-week period between March and April 2024 in Sorong, Southwest Papua, Indonesia. The target population included breastfeeding mothers with infants aged 0–6 months residing in the region. Participants were recruited through community health centers and screened for eligibility. Inclusion criteria included being actively breastfeeding and free from physical or psychological conditions that could interfere with lactation. Mothers were excluded if they were unable to commit to all intervention sessions or if they had experienced postpartum complications, bereavement, recent divorce, or relocation during the study period.

Sample size was calculated based on power analysis for two independent groups with repeated measurements. The calculation considered a power of 80% ($1–\beta = 0.80$), a significance level of 5% ($\alpha = 0.05$, two-tailed), effect size ($r = 0.50$) based on anticipated differences in breast milk production, and Z-values of $Z_1 = 1.96$ (for α) and $Z_2 = 0.84$ (for β). This resulted in a required minimum of 31 participants per group. To account for a potential 10–15% attrition rate, a total of 70 mothers were enrolled and equally allocated to the intervention group ($n = 35$) and control group ($n = 35$) using simple random sampling. The intervention group received four weekly NLP sessions (60 minutes each), delivered by a certified NLP practitioner. The control group received standard breastfeeding education without NLP techniques. Data were collected at three time points: preintervention, immediately after the final session, and 1 month post intervention.

This study employed a quasi-experimental pre–post-test design to assess the effects of NLP on breastfeeding outcomes among mothers in Sorong, Southwest Papua, Indonesia. The study was conducted over a 4-week period from March to April 2024. Eligible participants were breastfeeding mothers with infants aged 0–6 months, recruited through community health centers. Inclusion criteria included currently breastfeeding, willingness to participate, and absence of serious physical or psychological conditions affecting lactation. Mothers were excluded if they had postpartum complications, experienced bereavement or divorce, relocated during the study, or were unable to attend all intervention sessions. Sample size was determined using power analysis for two independent groups with repeated measurements, assuming a significance level of $\alpha = 0.05$ (two-tailed), a power of 80% ($1–\beta = 0.80$), and an effect size of $r = 0.5$. The Z-values used were $Z_1 = 1.96$ and $Z_2 = 0.84$. This yielded a minimum sample of 31 participants per group. To account for attrition, 70 participants were enrolled and randomly assigned to the intervention ($n = 35$) and control ($n = 35$) groups. The intervention group received four weekly NLP sessions (60 minutes each) administered by a certified practitioner from the National Federation of Neuro-Linguistic Programming (NFNLP), while the control group received standard breastfeeding education without NLP components [Table 1].

The intervention was structured to address psychological and emotional barriers to lactation. Each weekly session focused on a specific NLP technique, including goal setting, anchoring, visualization, and reinforcement through social support. Data were collected at baseline, immediately after the intervention, and 1 month post intervention. Breast milk production was assessed using graduated measuring cups, with mothers instructed to express and record milk volume twice daily; daily averages were calculated under consistent and standardized procedures. Stress levels were evaluated using the Perceived Stress Scale (PSS), a 10-item validated tool, while emotional wellbeing was assessed using the Positive Feelings Index Scale (ASIPP), which measured maternal self-confidence, emotion regulation, and marital satisfaction on a 5-point Likert scale. ASIPP demonstrated excellent reliability (Cronbach's $\alpha > 0.87$ for all domains). Descriptive statistics were used to summarize demographic characteristics. Analysis of Variance (ANOVA) was applied to compare changes in breast milk volume, stress, and emotional wellbeing between groups across the three time points. Statistical analysis was conducted using Jamovi software, with a significance threshold set at $p < 0.05$.

Ethical considerations

Ethical approval was obtained from the Health Polytechnic Ethics Committee (Ref: DM.03.01/4.1/0735/2024), and written informed consent was obtained from all participants prior to the study.

Results

Ethical considerations

This study was approved by the Health Polytechnic Research Ethics Committee of the Ministry of Health Sorong under project number DM.03.01/4.1/0735/2024. Written informed consent was obtained from all participants prior to data collection, and all procedures were conducted in accordance with the Declaration of Helsinki.

Demographic characteristics of participants

This study comprised 70 breastfeeding mothers equally distributed between the intervention NLP and control groups.

The demographic characteristics of both groups were comparable, with no statistically significant differences observed in age, education, employment status, socioeconomic status, parity, breastfeeding duration, BMI, social support, or previous lactation problems (all $p > 0.05$). This homogeneity supports the hypothesis that the observed outcomes are more likely attributable to the NLP intervention rather than to extraneous variables. The demographic and clinical characteristics of the participants are presented in Table 2.

Milk production

Milk production was assessed at three distinct time intervals: prior to the intervention, immediately after the intervention, and 1 month post intervention. The volume of breast milk produced, measured in millilitres (ml) per day, was determined using graduated measuring cylinders.

The findings of this study indicate that NLP intervention significantly enhanced breast milk production. The data revealed no significant difference in milk production between the intervention and control groups prior to the intervention ($p = 0.782$), suggesting initial homogeneity between the groups. However, following the intervention, the intervention group demonstrated a significant increase in milk production compared with the control group ($p = 0.032$). This increase was sustained 1 month post intervention, with the intervention group producing an average of 600 ml/day, while the control group remained stable at 480 ml/day, showing a significant difference ($p = 0.015$). The average milk production at three time points is detailed in Table 3.

Stress Levels and Emotional Wellbeing

The stress levels and emotional wellbeing of breastfeeding mothers were evaluated using two primary instruments: the PSS to assess stress levels and the ASIPP to evaluate emotional wellbeing. These variables were measured at three distinct time points: prior to the intervention, immediately following the intervention, and 1 month post intervention. The findings presented in Table 4 indicate

Table 1: Weekly sessions of NLP* intervention

Week	Session Topic	NLP Techniques Used	Purpose
Week 1	Introduction to NLP and Goal Setting	• Introduction to NLP principles • Individual goal setting	To enhance mothers' self-awareness and motivation for breastfeeding.
Week 2	Anchoring Technique for Stress Management	• Anchoring technique to create positive emotional associations	To reduce stress and increase confidence during breastfeeding.
Week 3	Visualization and Sub modalities	• Visualization techniques • Use of sub modalities to alter negative perceptions	To transform negative feelings and discomfort into positive breastfeeding experiences.
Week 4	Progress Evaluation and Social Support	• Evaluation of participants' progress • Discussion on the importance of social support	To reinforce learned techniques, assess progress, and emphasize the role of social support in breastfeeding success.

*NLP – Neuro-Linguistic Programming

Table 2: Demographic and clinical characteristics of participants

Characteristic	Intervention Group (*n*=35)	Control Group (*n*=35)	*p*
Age (years)	28.40 (5.20)	29.10 (4.80)	0.542
Parity (Primipara/Multipara)	18/17	16/19	0.762
Duration of Breastfeeding (months)	2.10 (1.30)	2.30 (1.20)	0.731
Education – High School (%)	12 (34.30)	11 (31.40)	0.814
Education – College (%)	23 (65.70)	24 (68.60)	0.903
Occupation – Housewife (%)	20 (57.10)	18 (51.40)	0.623
Occupation – Employed (%)	15 (42.90)	17 (48.60)	0.677
Socioeconomic Status – Low (%)	14 (40.00)	13 (37.10)	0.783
Socioeconomic Status – Medium (%)	21 (60.00)	22 (62.90)	0.907
Body Mass Index (BMI)	23.40 (3.10)	23.70 (2.90)	0.672
Smoking History (%)	2 (5.70)	3 (8.60)	0.642
Social Support (Yes/No)	32/3	33/2	0.534
Previous Lactation Issues (%)	5 (14.30)	6 (17.10)	0.763

statistically significant differences in stress reduction and enhancements in emotional wellbeing in the intervention group compared to the control group.

Stress levels and emotional wellbeing scores were assessed at three distinct time points: prior to the intervention, immediately following the intervention, and 1 month post intervention. Initial stress levels did not differ significantly between the groups before the intervention (p = 0.872). However, after the NLP intervention, the intervention group exhibited a statistically significant reduction in stress levels compared to the control group, both immediately post intervention (16.7 vs. 20.3; p = 0.041) and 1 month post intervention (14.5 vs. 19.8; p = 0.028). Similarly, emotional wellbeing showed significant improvement in the intervention group, with ASIPP scores increasing from 55.2 at baseline to 63.8 immediately post intervention and 68.2 at 1 month, in contrast to the control group scores of 58.9 and 59.3 (p = 0.041 and p = 0.028, respectively). These findings indicate that the NLP intervention effectively reduced stress and enhanced the emotional wellbeing of breastfeeding mothers.

Emotional wellbeing

Emotional wellbeing demonstrated significant improvement in the intervention group across all three dimensions: Maternal Self-Confidence, Emotion Regulation, and Marital Satisfaction. The ASIPP scores showed progressive increases at all time points, indicating the positive impact of the NLP intervention on emotional health [Table 5].

Table 3: Average milk production at three time points

Measurement Time	Intervention Group (ml/day Mean (SD)	Control Group (ml/day) Mean (SD)	*p*
Before Intervention	450(80.20)	460(85.40)	0.782
Immediately After Intervention	550(75.10)	475(80.30)	0.032*
One Month After Intervention	600(70.50)	480(78.80)	0.015*

*Statistical significance (p<0.05)

Table 5 illustrates the notable enhancements in the three dimensions of emotional wellbeing after the NLP intervention. Maternal Self-Confidence increased from a mean score of 18.5 prior to the intervention to 25.0 1 month post intervention. Similarly, Emotion Regulation improved from 17.4 to 23.4, and Marital Satisfaction increased from 16.0 to 23.5. ANOVA confirmed that these differences were statistically significant between the intervention and control groups, thereby demonstrating the efficacy of the NLP intervention in augmenting the emotional wellbeing of breastfeeding mothers.

Discussion

The findings of this study are consistent with those of prior research, indicating that psychological interventions, such as NLP, can affect the biological mechanisms underlying breast milk production.

For instance, Gómez *et al*. and Modak *et al*. highlighted the significance of reducing stress and enhancing emotional wellbeing to improve lactation outcomes.[4,35] Similarly, Matyas *et al*. (2024)[36] reported that maternal psychological stress adversely affects milk production, corroborating the observed reduction in stress and enhancement in milk output among mothers in the intervention group in this study. These findings bolster the argument for a holistic approach to breastfeeding support that incorporates psychological components.

However, contradictory findings have been reported. For example, Nagel *et al*.[37] contended that stress reduction alone might not be sufficient to significantly enhance lactation outcomes as other physiological and social factors are critical. Likewise, Malgaroli *et al*.[38] questioned the generalizability of psychological interventions such as NLP, particularly in culturally diverse populations. These discrepancies underscore the complexity of lactation and the necessity for multifaceted strategies that address not only psychological but also environmental and biological factors.

Table 4: Changes in stress levels and emotional wellbeing

Measurement Time	Stress Level Intervention Mean (SD)	Stress Level Control Mean (SD)	*p*	Emotional Well-Being Intervention Mean (SD)	Control Mean (SD)	*p*
Before Intervention	22.40 (3.80)	22.10 (4.10)	0.872	55.20 (5.40)	54.80 (5.20)	0.853
Immediately After	16.70 (3.20)	20.30 (3.90)	0.041*	63.80 (4.70)	58.90 (4.60)	0.041*
One Month After	14.50 (3.10)	19.80 (3.70)	0.028*	68.20 (4.20)	59.30 (4.50)	0.028*

Values are presented as Mean (Standard Deviation). p<0.05 indicates statistical significance (*). Stress was measured using the Perceived Stress Scale (PSS); emotional wellbeing was assessed using the Positive Feelings Index Scale (ASIPP)

Table 5: Results of emotional wellbeing

Aspects of Emotional Well-Being	Before Intervention Mean(SD)	Immediately After Intervention Mean(SD)	One Month After Intervention Mean(SD)
Maternal Self-Confidence	18.50(3.20)	22.70(2.80)	25.0(2.50)
Emotion Regulation	17.40(3.50)	20.10(3.0)	23.40(2.60)
Marital Satisfaction	16.0(4.10)	20.0(3.80)	23.50(3.10)

The present study identified significant reductions in stress levels among breastfeeding mothers following the NLP intervention, as evidenced by a decrease in PSS scores from 22.4 to 14.5, 1 month post intervention. This finding is consistent with the work of İşcanoğlu *et al*.,[39] who emphasized the importance of emotion regulation in alleviating psychological distress, particularly in challenging situations such as breastfeeding.

However, it is important to note that while emotion regulation improved in the intervention group, other factors, such as the role of hormonal responses to stress and their direct effects on milk production, were not assessed in this study. Future studies should investigate these biological mechanisms to provide a more comprehensive understanding of this phenomenon. The significant improvement in emotional wellbeing, as reflected in the ASIPP scores, underscores the multifaceted benefits.

These findings align with those of Billings *et al*.,[20] who demonstrated that psychological interventions could enhance maternal confidence and breastfeeding experiences. Nonetheless, contrary evidence by Gavine *et al*.[40] suggests that while psychological support can improve mental health, it does not always lead to better breastfeeding outcomes unless combined with structured lactation education and support.

Additionally, the observed increase in marital satisfaction following NLP suggests that this intervention positively impacts not only individual wellbeing but also family dynamics.

This finding agrees with that of Durmazoğlu *et al*.,[41] who demonstrated that spousal support enhances breastfeeding outcomes. However, Buhler-Wassmann *et al*.[42] emphasized that the cultural context significantly mediates the effectiveness of family-centered interventions, which should be considered when generalizing these results to other populations.

Although this study offers promising evidence regarding the efficacy of NLP, it is crucial to recognize its limitations. External factors, such as social support, economic conditions, and cultural norms, may have influenced the outcomes and were not controlled for in this study. Furthermore, although quantitative measures are robust, they do not capture the depth of participants' experiences with the intervention. Future research should incorporate longitudinal designs to evaluate the long-term effects of NLP on breastfeeding and on emotional wellbeing. Additionally, exploring the physiological mechanisms underlying stress reduction during lactation may provide valuable insights. It is also advisable to investigate the efficacy of NLP across diverse demographic and cultural groups to enhance its generalizability.[24-29,33,34]

Finally, while qualitative methods are valuable for understanding participants' subjective experiences, they may not align with the primary objective of evaluating the efficacy of NLP in this study. Instead, future qualitative investigations could serve as complementary studies to provide a richer context for the quantitative findings. This study highlights the potential of NLP-based interventions to enhance maternal emotional wellbeing, reduce stress, and improve breastfeeding outcomes in the future. Despite certain limitations, the findings provide a foundation for integrating psychological support into maternal health programs, particularly in culturally unique contexts, such as Southwest Papua. Further research is necessary to address these gaps and expand the evidence base to ensure that these interventions are effective and culturally sensitive.

Although this study offers promising evidence regarding the efficacy of NLP, it is crucial to recognize its limitations. First, external factors such as social support, economic pressures, environmental stressors, and cultural norms were not fully controlled and may have influenced participant responses and outcomes. Second, while the quantitative tools used (e.g., PSS, ASIPP) are validated and reliable, they may not fully capture the complexity of mothers' subjective emotional experiences. Third, the relatively short follow-up period (1 month post intervention) limits the ability to assess the long-term sustainability of the observed improvements in lactation and emotional wellbeing.

Additionally, the study relied on self-reported emotional data and did not assess biological indicators such as hormonal profiles (e.g., cortisol or prolactin), which could have provided a more comprehensive understanding of the physiological impact of NLP. The sample was also drawn from a single geographic region (Southwest Papua), which may affect the generalizability of the findings to other cultural or socioeconomic settings. Furthermore, the intervention required a certified NLP practitioner, which may limit scalability in low-resource settings without sufficient trained personnel.

Future studies should consider incorporating longitudinal designs, larger and more diverse populations, and mixed-method approaches to capture both objective and experiential data. Exploring biological mechanisms and adapting NLP content to local cultures could further enhance its relevance and impact.

Despite these limitations, the study provides foundational evidence that NLP can improve maternal emotional wellbeing, reduce stress, and enhance breastfeeding outcomes. These findings support the integration of psychological strategies into maternal and child health programs, particularly in culturally unique and under-resourced areas such as Southwest Papua.

In line with the increasing utilization of artificial intelligence and natural language processing (NLP) in mental health and educational interventions,[24-27] this study aligns with emerging evidence on the application of NLP techniques in psychological and behavioral modifications.[28,29] Moreover,

factors such as postpartum depression and psychological distress are well-established barriers to breastfeeding success,[33] and the use of NLP alongside relaxation techniques has been explored in similar maternal health contexts.[34]

Conclusion

The results indicated that NLP intervention significantly enhanced maternal self-confidence, emotion regulation, and marital satisfaction, thereby contributing to overall improvements in emotional wellbeing. These findings underscore the potential of psychological approaches to support breastfeeding mothers and highlight the effectiveness of NLP-based interventions as strategies for improving the breastfeeding experience. Nonetheless, this study has certain limitations, including a limited sample size and the inability to account for external variables that may influence the results. Future research should address these limitations by employing larger sample sizes and considering the impact of contextual factors, such as socioeconomic conditions and cultural influences, on breastfeeding outcomes. Although this study provides preliminary evidence for the application of NLP in breastfeeding support programs, further investigation is necessary to determine its long-term efficacy and applicability in diverse populations. The insights gained from this study contribute to the ongoing discourse on psychological interventions in maternal health and suggest the need for more robust and multifaceted approaches to enhance breastfeeding practices.

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Conflicts of interest

Nothing to declare.

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