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Research Article

EFFECTIVENESS OF WOOLWICH MASSAGE ON BREAST MILK PRODUCTION BASED ON MATERNAL AND INFANT INDICATORS AMONG POSTPARTUM MOTHERS: A QUASI-EXPERIMENTAL STUDY

Pariqa Annisa[1], Rina Oktaviana[2], Sri Putriani Sinaga[3]
[1] Universitas Muhammadiyah Riau, Indonesia
[2] Universitas Muhammadiyah Riau, Indonesia
[3] Institut Kesehatan Medistra Lubuk Pakam, Indonesia

Corresponding Author:

Pariqa Annisa,
Universitas Muhammadiyah Riau, Indonesia
Department of Midwifery, Faculty of MIPAKes, Universitas Muhammadiyah Riau
Email: pariqaannisa@umri.ac.id

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Abstract
Breast milk production is one of the major determinants of successful exclusive breastfeeding during the early postpartum period. Insufficient milk production often leads to early breastfeeding discontinuation and the introduction of infant formula. This study aimed to determine the effectiveness of Woolwich Massage on breast milk production based on both maternal and infant indicators among postpartum mothers. A quasi-experimental study with a pretest–posttest control group design was conducted at BPM Sasyuni, Kampar Regency, Indonesia, from January to March 2026. Thirty postpartum mothers were recruited using consecutive sampling and equally assigned to an intervention group (n = 15) and a control group (n = 15). Breast milk production was assessed using maternal indicators (breast fullness, breast softening, spontaneous milk leakage, let-down reflex, and absence of breast engorgement) and infant indicators (urination frequency, bowel movement frequency, infant satisfaction, sleep duration, and weight gain). The paired t-test revealed a significant increase in breast milk production scores in the intervention group (mean difference = 5.13 ± 0.99; $p < 0.001$), while the independent t-test demonstrated significantly greater improvement than the control group ($p < 0.001$). These findings suggest that Woolwich Massage is an effective, safe, and low-cost non-pharmacological intervention that can be integrated into routine postpartum midwifery care to support successful exclusive breastfeeding.

Keywords: Breastfeeding, Postpartum, Woolwich Massage

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INTRODUCTION

Breast milk is the optimal source of nutrition for infants because it contains essential macronutrients, micronutrients, immunoglobulins, enzymes, hormones, and bioactive compounds that support growth, development, and immune function (Lusambili, 2023; Vicariotto, 2023). Exclusive breastfeeding for the first six months of life has been shown to reduce the risks of infection, malnutrition, obesity, diabetes mellitus, and infant mortality, making it one of the most effective public health interventions for improving child survival. In addition, breastfeeding benefits maternal health by accelerating uterine involution and reducing the risks of postpartum hemorrhage and breast and ovarian cancers. Accordingly, the WHO and UNICEF recommend initiating breastfeeding within one hour after birth, providing exclusive breastfeeding for six months, and continuing breastfeeding up to two years or beyond with appropriate complementary feeding (Miuli, 2023; Tavares, 2023).

Despite these recommendations, exclusive breastfeeding remains below the global target. The World Health Assembly reaffirmed its commitment to achieving at least 60% exclusive breastfeeding coverage by 2030; however, global prevalence has not yet reached this target. Likewise, Indonesia has established a national target of 80%, but coverage remains inconsistent across regions (Ministry of Health of the Republic of Indonesia, 2023). These findings highlight the need for effective, evidence-based interventions to improve breastfeeding outcomes.

Insufficient breast milk production during the early postpartum period is one of the leading barriers to successful exclusive breastfeeding. Delayed lactogenesis, breast engorgement, nipple pain, fatigue, and maternal anxiety frequently reduce breastfeeding confidence and encourage the early introduction of infant formula (Dinleyici, 2025). Previous studies have identified inadequate milk production as a major contributor to breastfeeding failure during the first postpartum week. Breast milk production is influenced by multiple physiological and psychosocial factors, including maternal nutritional status, parity, previous breastfeeding experience, breast condition, stress, family support, breastfeeding techniques, and assistance from healthcare professionals.

Lactation is primarily regulated by prolactin and oxytocin. Prolactin stimulates milk synthesis in the mammary alveoli, whereas oxytocin promotes contraction of myoepithelial cells, facilitating milk ejection through the lactiferous ducts. Mechanical stimulation of the nipple through infant suckling or breast massage enhances the secretion of these hormones, while stress and anxiety inhibit oxytocin release and suppress the milk ejection reflex. Therefore, interventions that promote hormonal stimulation while reducing maternal stress may improve breastfeeding success (Henshaw, 2023; Scime, 2023).

Woolwich Massage has emerged as a promising non-pharmacological intervention to enhance breast milk production. The technique involves gentle massage of the lactiferous sinus surrounding the areola to stimulate prolactin and oxytocin secretion, thereby improving milk production and milk ejection. Besides stimulating the let-down reflex, Woolwich Massage promotes maternal relaxation, is inexpensive, easy to perform, and can be incorporated into routine postpartum care.

Previous studies have consistently demonstrated that Woolwich Massage improves breast milk production, increases milk volume, reduces breast engorgement, and enhances maternal comfort during breastfeeding. However, most studies have evaluated breastfeeding outcomes primarily using maternal subjective indicators, such as perceived milk sufficiency, breast fullness, or expressed milk volume. Few studies have simultaneously incorporated infant-related

indicators, including breastfeeding frequency, urinary and bowel output, infant satisfaction, and weight gain, which more accurately reflect breastfeeding adequacy (Goldshtein, 2025; Lojander, 2024).

Therefore, an important research gap remains regarding the comprehensive assessment of breast milk production following Woolwich Massage. The novelty of the present study lies in evaluating the effectiveness of Woolwich Massage using both maternal and infant indicators simultaneously. This integrated approach is expected to provide more comprehensive evidence regarding breastfeeding success and strengthen the scientific basis for implementing Woolwich Massage as an evidence-based, non-pharmacological intervention in postpartum midwifery care (Maryati et al., 2023).

RESEARCH METHOD

Research Design

This study employed a quasi-experimental design using a pretest–posttest control group design to evaluate the effectiveness of Woolwich Massage on breast milk production among postpartum mothers. The study was conducted at BPM Sasyuni, Kampar Regency, Indonesia, from January to March 2026.

Research Target/Subject

The study population consisted of all postpartum mothers from the first to the seventh day after normal vaginal delivery. Participants were recruited using a consecutive sampling technique, whereby all eligible mothers were enrolled consecutively until the required sample size was achieved. A total of 30 postpartum mothers participated in the study and were equally allocated into two groups: 15 mothers in the intervention group and 15 mothers in the control group.

The inclusion criteria were postpartum mothers who had a normal vaginal delivery, delivered a healthy full-term infant (37–42 weeks of gestation), breastfed their infants directly, and were willing to participate by providing written informed consent. Mothers diagnosed with mastitis, breast abnormalities that could interfere with breastfeeding, contraindications to breastfeeding, or whose infants required admission to the Neonatal Intensive Care Unit (NICU) were excluded from the study.

Research Procedure

The independent variable was the administration of Woolwich Massage, whereas the dependent variable was breast milk production. Woolwich Massage was performed by trained midwives according to a standardized operating procedure (SOP). The massage was applied to the lactiferous sinus, approximately 1–1.5 cm above the areola, using gentle circular movements for 15 minutes, twice daily, over three consecutive days (Mahurin-Smith, 2023).

Table 1. Operational Definitions of Research Variables

Variable	Operational Definition	Indicators
Woolwich Massage	A non-pharmacological intervention involving massage of the lactiferous sinus approximately 1–1.5 cm above the areola using gentle circular movements for 15 minutes, twice daily, for three consecutive days	The intervention is administered according to the established SOP by trained midwives.

	according to the Standard Operating Procedure (SOP).	
Breast Milk Production	The mother's ability to produce breast milk, assessed using a combination of maternal and infant indicators during the postpartum period.	Maternal indicators: (1) breast fullness before breastfeeding, (2) breast softening after breastfeeding, (3) spontaneous milk leakage, (4) presence of the let-down reflex, and (5) absence of breast engorgement. Infant indicators: (1) urinary frequency ≥6 times/day, (2) normal bowel movement frequency, (3) infant satisfaction after breastfeeding, (4) adequate sleep duration after feeding, and (5) neonatal weight gain.

Instruments, and Data Collection Techniques

Data collection began with a pretest on the first postpartum day to assess baseline breast milk production. The intervention group subsequently received Woolwich Massage twice daily for three consecutive days in addition to routine postpartum care. Meanwhile, the control group received routine postpartum care and standard breastfeeding education according to the existing clinical protocol. A posttest was conducted on the fourth postpartum day using the same observation instrument to evaluate changes in breast milk production following the intervention.

Data Analysis Technique

Data were analyzed using IBM SPSS Statistics. Descriptive (univariate) analysis was performed to summarize participant characteristics and breast milk production scores using means, standard deviations, frequencies, and percentages. Data normality was assessed using the Shapiro Wilk test. For normally distributed data, within-group comparisons were analyzed using the paired t-test, while between-group comparisons were performed using the independent t-test. If the data were not normally distributed, the Wilcoxon signed-rank test and the Man Whitney U test were applied. Statistical significance was established at $p < 0.05$

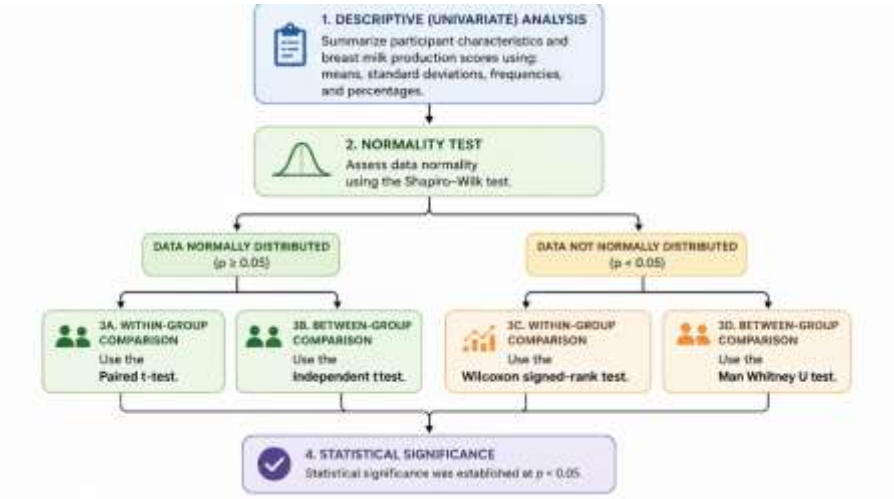


Figure 1. Flowchart of the Statistical Data Analysis Procedure

Figure 1 illustrates the statistical data analysis workflow used in this study. The analysis began with descriptive (univariate) statistics to summarize participant characteristics and breast milk production scores using means, standard deviations, frequencies, and percentages. Data normality was subsequently assessed using the Shapiro–Wilk test to determine the appropriate inferential statistical method. For normally distributed data ($p \geq 0.05$), within-group comparisons were analyzed using the paired *t*-test, while between-group comparisons were performed using the independent *t*-test. Conversely, for data that were not normally distributed ($p < 0.05$), within-group differences were evaluated using the Wilcoxon signed-rank test, and between-group differences were assessed using the Mann–Whitney U test. Statistical significance for all analyses was established at a threshold of $p < 0.05$, ensuring that the selected statistical procedures were appropriate for the distributional characteristics of the collected data.

RESULTS AND DISCUSSION

The characteristics evaluated include age, educational level, occupation, parity, body mass index (BMI), and mode of delivery, all of which represent important factors that may influence maternal health outcomes and the effectiveness of the intervention. A balanced distribution of these variables between the two groups is essential to minimize potential confounding effects and ensure that any observed differences in study outcomes are primarily attributable to the intervention rather than pre-existing participant characteristics. Therefore, the baseline data provide an important foundation for interpreting the subsequent comparative analyses and assessing the internal validity of the study findings.

Table 2. Characteristics of Respondents in the Intervention and Control Groups

Characteristics	Category	Intervention (n=15) n (%)	Control (n=15) n (%)
Age (years)	<20	1 (6.7)	1 (6.7)
	20–35	12 (80.0)	11 (73.3)
	>35	2 (13.3)	3 (20.0)
Education	Primary School	1 (6.7)	1 (6.7)
	Junior High School	2 (13.3)	2 (13.3)
	Senior High School	8 (53.3)	9 (60.0)
	College/University	4 (26.7)	3 (20.0)
Occupation	Housewife	10 (66.7)	9 (60.0)
	Private Employee	3 (20.0)	4 (26.7)
	Civil Servant	1 (6.7)	1 (6.7)
	Entrepreneur	1 (6.7)	1 (6.7)
Parity	Primipara	7 (46.7)	8 (53.3)
	Multipara	8 (53.3)	7 (46.7)
Body Mass Index (BMI)	Underweight (<18.5 kg/m²)	1 (6.7)	1 (6.7)
	Normal (18.5–24.9 kg/m²)	10 (66.7)	9 (60.0)
	Overweight (25.0–29.9 kg/m²)	3 (20.0)	4 (26.7)
	Obese (≥30.0 kg/m²)	1 (6.7)	1 (6.7)
Mode of Delivery	Vaginal Delivery	11 (73.3)	10 (66.7)
	Cesarean Section	4 (26.7)	5 (33.3)

Table 2 shows that the baseline characteristics of respondents were relatively similar between the intervention and control groups. Most mothers were aged 20–35 years, had completed senior high school, were housewives, were multiparous, had a normal body mass index, and delivered vaginally. These findings indicate that both groups had comparable baseline characteristics before the intervention.

Table 3. Comparison of Breast Milk Production Indicators Before and After the Intervention in the Intervention and Control Groups

Breast Milk Production Indicators	Intervention (n=15)	Control (n=15)
	Pretest n (%)	Posttest n (%)
Maternal Indicators		
Breasts feel full before breastfeeding	5 (33.3)	14 (93.3)
Breasts feel soft after breastfeeding	4 (26.7)	13 (86.7)
Spontaneous milk leakage	3 (20.0)	12 (80.0)
Let-down reflex present	6 (40.0)	15 (100.0)
No breast engorgement	9 (60.0)	15 (100.0)
Infant Indicators		
Urination frequency ≥6 times/day	4 (26.7)	14 (93.3)
Normal bowel movement frequency	8 (53.3)	15 (100.0)
Infant appears satisfied after breastfeeding	5 (33.3)	14 (93.3)
Infant sleeps 2–3 hours after breastfeeding	6 (40.0)	13 (86.7)
Infant weight gain	2 (13.3)	12 (80.0)

Table 3 demonstrates improvements in both maternal and infant breast milk production indicators following the intervention. In the intervention group, substantial increases were observed in all maternal indicators, including breast fullness before breastfeeding, breast softness after breastfeeding, spontaneous milk leakage, presence of the let-down reflex, and absence of breast engorgement. Similar improvements were also found in infant indicators, including urination frequency, bowel movement frequency, infant satisfaction after breastfeeding, sleep duration after feeding, and weight gain. In contrast, the control group showed only modest improvements across these indicators.

Table 4. Comparison of Breast Milk Production Scores Before and After the Intervention Using Paired t-test

Group	Measurement	Mean ± SD	Mean Difference	95% CI	t	p-value
Intervention (n=15)	Pretest	4.13 ± 1.06				
	Posttest	9.27 ± 0.80	5.13 ± 0.99	4.58–5.68	20.08	<0.001
Control (n=15)	Pretest	4.80 ± 1.15				
	Posttest	6.67 ± 1.18	1.87 ± 0.92	1.36–2.38	7.86	<0.001

Table 4 indicates a statistically significant increase in breast milk production scores in both groups after the study period. The intervention group showed a markedly greater improvement, with the mean score increasing from 4.13 ± 1.06 to 9.27 ± 0.80 ($p < 0.001$), whereas the control group increased from 4.80 ± 1.15 to 6.67 ± 1.18 ($p < 0.001$). The larger mean difference

observed in the intervention group suggests that Woolwich Massage substantially improved breast milk production.

Table 5. Comparison of Changes in Breast Milk Production Scores Between the Intervention and Control Groups

Variable	Intervention (n=15)Mean ± SD	Control (n=15) Mean ± SD	Mean Difference	t	p-value
Δ Breast milk production score (Posttest − Pretest)	5.13 ± 0.99	1.87 ± 0.92	3.26	9.34	<0.001

Table 5 shows that the mean change in breast milk production scores was significantly higher in the intervention group (5.13 ± 0.99) than in the control group (1.87 ± 0.92). The independent t-test demonstrated a statistically significant difference between groups (t = 9.34, p < 0.001), indicating that Woolwich Massage was significantly more effective than standard postpartum care in improving breast milk production among postpartum mothers.

The results of this study demonstrated that Woolwich Massage significantly improved breast milk production among postpartum mothers. This finding was evidenced by the increase in the mean breast milk production score in the intervention group from 4.13 ± 1.06 before the intervention to 9.27 ± 0.80 after the intervention (p < 0.001). In contrast, the control group showed only a modest increase in the mean score from 4.80 ± 1.15 to 6.67 ± 1.18, although the difference was also statistically significant. However, the magnitude of improvement in the intervention group was considerably greater than that observed in the control group. Furthermore, the independent t-test revealed a significant difference in the mean change in breast milk production scores between the two groups (p < 0.001). These findings indicate that Woolwich Massage is an effective non-pharmacological intervention for enhancing breast milk production in postpartum mothers, consistent with previous studies conducted by Sevda, (2023).

Improvements in breast milk production were observed in both maternal and infant indicators. Maternal indicators showed marked improvements in breast fullness before breastfeeding, breast softness after breastfeeding, spontaneous milk leakage, the presence of the let-down reflex, and the absence of breast engorgement. Likewise, infant indicators demonstrated substantial improvements, including increased urination frequency (≥6 times/day), normal bowel movement frequency, infant satisfaction after breastfeeding, sleep duration of 2–3 hours following feeding, and infant weight gain. These findings suggest that evaluating breast milk production using both maternal and infant indicators provides a more comprehensive assessment of breastfeeding success than relying solely on maternal perception or expressed milk volume. According to the (Mottl-Santiago, 2023) and (Haben, 2023), infant feeding behaviors, urinary frequency, bowel movements, and weight gain are reliable clinical indicators of adequate breast milk intake.

The physiological mechanism underlying the effectiveness of Woolwich Massage can be explained through neuroendocrine stimulation of the mammary gland. Woolwich Massage is performed by applying gentle pressure around the lactiferous sinus near the areola, stimulating sensory nerve endings that transmit impulses to the hypothalamus. These impulses activate the anterior pituitary gland to secrete prolactin, which is responsible for milk synthesis, and the posterior pituitary gland to release oxytocin, which stimulates contraction of the myoepithelial

cells surrounding the mammary alveoli. Consequently, both milk production and milk ejection are enhanced, resulting in improved breastfeeding performance. This physiological mechanism is consistent with the theory of lactation described by Chichlowski, (2023).

In addition to promoting milk production, Woolwich Massage contributes to maternal relaxation during the postpartum period. Psychological factors such as stress, anxiety, fatigue, and lack of confidence are known to inhibit oxytocin secretion, thereby impairing the milk ejection reflex. Breast massage improves local blood circulation, reduces breast discomfort, promotes relaxation, and facilitates oxytocin release, which ultimately supports effective breastfeeding. In the present study, all mothers in the intervention group demonstrated the presence of the let-down reflex after receiving Woolwich Massage, indicating improved neurohormonal responses associated with lactation. These findings support the physiological concept that successful breastfeeding depends not only on adequate milk synthesis but also on efficient milk ejection (Liu, 2023).

The findings of this study are consistent with those reported by Moriyama, (2024), who demonstrated that the combination of Woolwich Massage and oxytocin massage significantly increased breast milk production among postpartum mothers. Dinengsih explained that mechanical stimulation of the breast enhances prolactin and oxytocin secretion, thereby accelerating lactogenesis. Although the present study evaluated Woolwich Massage as a single intervention, the significant improvement observed suggests that Woolwich Massage alone is sufficient to stimulate physiological lactation mechanisms effectively.

Similarly, Li, (2023) reported that combining Woolwich Massage with oxytocin massage significantly improved breast milk production among postpartum mothers. Their study suggested that stimulation of the lactiferous sinus promotes complete breast emptying, thereby increasing prolactin secretion through the physiological principle of supply and demand. The findings of the present study support this mechanism, as mothers who received Woolwich Massage experienced greater improvements in both maternal and infant indicators compared with those receiving routine postpartum care.

The present findings are also supported by Ramey-Collier, (2023), who reported that Woolwich Massage combined with the Marmet technique significantly enhanced breast milk production among postpartum mothers. While the Marmet technique facilitates manual breast emptying, Woolwich Massage stimulates hormonal responses associated with lactation. Interestingly, despite using Woolwich Massage without additional breast stimulation techniques, the present study demonstrated a substantial increase in breast milk production, suggesting that Woolwich Massage alone is an effective intervention.

Furthermore, the results are in agreement with those reported by Pérez-Jiménez, (2023), who found that Woolwich Massage effectively improved breast milk flow among postpartum mothers attending a primary maternity clinic. Their study showed reductions in breast engorgement and improvements in breastfeeding effectiveness following the intervention. Likewise, (Ma, 2023) demonstrated that Woolwich Massage significantly increased breast milk production among postpartum mothers, while Acar, (2024) reported significant improvements in average breast milk production following the intervention in an independent midwifery practice. Collectively, these studies strengthen the evidence supporting Woolwich Massage as an effective intervention for improving lactation outcomes.

Another study by Eckermann, (2024) demonstrated that combining rolling breast massage with Woolwich Massage significantly increased breast milk volume among breastfeeding

mothers. Although the intervention differed slightly from the present study, both studies share a similar physiological basis involving stimulation of prolactin and oxytocin secretion. Therefore, breast massage techniques remain effective, low-cost, and safe non-pharmacological strategies for improving breastfeeding success.

A major strength and novelty of the present study is the inclusion of both maternal and infant indicators to evaluate breast milk production. Most previous studies have primarily relied on maternal perceptions, breast fullness, or expressed milk volume as outcome measures (Konukbay, 2024). In contrast, the present study incorporated objective infant indicators, including urination frequency, bowel movement frequency, infant satisfaction after breastfeeding, sleep duration, and weight gain. These indicators provide a more comprehensive evaluation of breastfeeding adequacy because they directly reflect the infant's nutritional intake and physiological response to breastfeeding (Josan, 2023). Therefore, the use of combined maternal and infant indicators represents an important contribution to the current evidence regarding the effectiveness of Woolwich Massage.

Overall, the findings of this study provide strong evidence that Woolwich Massage is a safe, inexpensive, and easily applicable non-pharmacological intervention for improving breast milk production among postpartum mothers (Zhao, 2023). The intervention can be integrated into routine postpartum midwifery care to support successful exclusive breastfeeding. Midwives may also educate mothers and family members to perform Woolwich Massage independently at home as part of breastfeeding support. Future studies should include larger sample sizes, longer follow-up periods, and objective hormonal measurements, such as serum prolactin and oxytocin levels, to further elucidate the physiological mechanisms underlying the effectiveness of Woolwich Massage and its long-term impact on exclusive breastfeeding outcomes (Daw, 2024).

CONCLUSION

This study demonstrated that Woolwich Massage is an effective non-pharmacological intervention for improving breast milk production among postpartum mothers. Mothers who received Woolwich Massage showed significantly greater improvements in breast milk production compared with those who received routine postpartum care, as evidenced by both maternal indicators (breast fullness before breastfeeding, breast softness after breastfeeding, spontaneous milk leakage, presence of the let-down reflex, and absence of breast engorgement) and infant indicators (urination frequency, bowel movement frequency, infant satisfaction after breastfeeding, sleep duration, and weight gain). These findings indicate that Woolwich Massage enhances lactation by stimulating the physiological mechanisms involved in breast milk synthesis and ejection.

The use of combined maternal and infant indicators represents an important contribution to the assessment of breastfeeding effectiveness, providing a more comprehensive evaluation than studies relying solely on maternal perception or expressed milk volume. Therefore, Woolwich Massage can be recommended as an evidence-based, safe, low-cost, and easily applicable intervention that can be incorporated into routine postpartum midwifery care to support successful exclusive breastfeeding.

Future studies are recommended to include larger sample sizes, multicenter settings, longer follow-up periods, and objective biomarkers such as serum prolactin and oxytocin levels to further confirm the physiological effects of Woolwich Massage and evaluate its long-term impact on exclusive breastfeeding and infant growth.

DECLARATION OF AI AND AI ASSISTED TECHNOLOGIES IN THE WRITING PROCESS

During the preparation of this work the author(s) used Google Assisted to assist in improving grammar, language quality, and overall readability of the text. After using this tool/service, the author(s) reviewed and edited the content as needed and take(s) full responsibility for the content of the publication.

AUTHOR CONTRIBUTIONS

Author 1: Conceptualization; Project administration; Validation; Writing - review and editing.
Author 2: Conceptualization; Data curation; In-vestigation.
Author 3: Data curation; Investigation.

DECLARATION OF COMPETING INTEREST

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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