ORIGINAL ARTICLE

Effect of Dual Power Pumping on Breast Milk Production Among Mothers by Age and Parity

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ABSTRACT

Introduction: Insufficient breast milk production threatens Indonesia's goal of exclusive breastfeeding by 2023. This study evaluated the impact of dual power pump (DPP) intervention on breast milk production in primiparous and multiparous mothers aged 20 to ≥30 years. **Methods:** Quasi-experimental with pre-post test group design on 30 breastfeeding mothers in the Samarinda clinic. Statistical analysis using a paired t-test and a Wilcoxon test. **Results:** There was a significant increase in breast milk production before and after the DPP intervention in those aged 20 to ≥ 30 years (p-value < 0.005), primipara, and multipara (p-value < 0.001). Based on the study, optimal milk production occurred in mothers aged between 20 - 30 years, with more than 50% achieving excellent milk composition. Breastfeeding exclusivity showed 90% in multipara mothers in their 20s and more than 70% in mothers in their 40s. Most mothers start expressing breastmilk six weeks after delivery. Effective milk production can prevent the build-up of polypeptide feedback inhibitors so that there is no barrier to lactation feedback, and this depends on the baby's sucking, stimulation of oxytocin release, frequency, and duration of pumping. **Conclusion:** The DPP procedure can increase adequate milk production in mothers aged 20 - ≥30 years, both primipara and multipara. More frequent pumping without direct breastfeeding may lead to a shorter duration of milk production.

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INTRODUCTION

The initial decision to stop breastfeeding was due to insufficient milk production for the baby (1–3). Perceived insufficient milk supply (IMS) is one of the main reasons for discontinuing breastfeeding, with the incidence of IMS ranging from 10% to 25% (4). Study of 473 primipara and multipara mothers who stopped breastfeeding within 6 months because they 'felt there was not enough milk' (p=0.001) (5). The percentage of exclusively breastfed infants is 90% among multipara mothers in their 20s and 70% or higher among those in their 40s. Additionally, the rate of exclusive breastfeeding is significantly higher in multipara mothers compared to primipara mothers at various ages, specifically at 1 week and 1 month (6). Multipara mothers can breastfeed in their 40s, but primipara mothers often have difficulties after the age of 35. This suggests that not only the age of the mother but also the number of children should be considered in the breastfeeding experience to provide effective psychological support for breastfeeding mothers (6).

Age, parity, and gender influence breastmilk production (5). More parity was associated with longer duration of breastfeeding (p<0.005) (7). Efforts to maintain breastmilk production include modifying breastmilk to suit the infant's needs, ensuring consistent breastfeeding, and regular pumping (5,8). A pumping pattern that mimics a baby's suction may yield better results. (9). Expressing breastmilk is pumping or extracting breastmilk with the mother's hands, and then giving the milk to the baby using a cup, spoon, or bottle (10). Exclusive breastfeeding with an electric pump is more effective

than manual pumping for increasing milk supply in low birth weight infants (11). The pump's ability to express milk depends on the amount and speed of vacuum suction (12). Implementation of DPP interventions for breastfeeding mothers in Samarinda is essential to counter the low exclusive breastfeeding rate of 66%. This study evaluated DPP in influencing breastmilk production based on maternal age and parity.

MATERIALS AND METHODS

Experimental Design

The study was conducted in Samarinda Clinic, Indonesia, with a quasi-experimental design of one group pre-post-test. Pretest of breast milk production, then DPP 8x per day for six days, and posttest daily to assess changes in breast milk production.

Sample

We sampled a total population of 30 breastfeeding mothers at the clinic using a purposive random sampling technique. Focus on those who were breastfeeding healthy infants, exclusively breastfed, infant age 2-6 months, normal birth, birth weight of at least 2500g, strong sucking reflex, and no previous pumping of breast milk.

Trial Procedures

Biodata and interviews were used to collect sample data. Breast milk volume was assessed at baseline. DPP intervention with the following cycles: 1) 20 minutes expression, 2) 10 minutes rest, 3) 10 minutes expression, 4) 10 minutes rest, and 5) 10 minutes expression. The DPP cycle is based on comparing milk supply from simultaneous expression of both breasts to sequential expression (Figure I) (13). The DPP was performed on both breasts 8 times a day for 6 days. A post-test was performed each day to measure milk output from the bottle to the breast pump.

Statistical Analysis

Sample characteristics included age, parity, and breastfeeding status. Paired T-test analysis assessed the difference in mean breast milk production before and after DPP intervention (p-value < 0.005). The Wilcoxon analysis assessed the difference in mean breast milk production before and after DPP intervention in positive and negative ranks (p-value < 0.001).

Ethical

Ethical recommendation from the Health Research Ethics Committee, Ministry of Health, Indonesia No: DP.04.03/7.1/07899/2023.

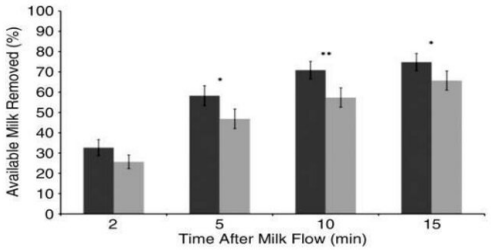

Figure 1: Percentage of human milk supply removed after minutes 2,5,10 and 15 of milking with simultaneous (dark grey) and sequential (light grey) techniques (n=31). Significant differences are indicated: *p<0.05, **p<0.01

RESULTS

Pre-post-intervention data on the milk production of 30 breastfeeding mothers. Most participants were aged 20-29 years (80% n = 24), and ≥ 30 years (20% n = 6). Primipara (63.3% n = 19) and multipara (36.7% n = 11) in Table I. Mean pre-post test breast milk production volume in mothers aged 20 - 29 years (265.83 mL - 379.17 mL), Cohen's d 0,13 and ≥ 30 years (288.33 mL - 378.33 mL), Cohen's d 0,11. Primipara (285.79 mL - 377.89 mL), Cohen's d 0,12, multipara (243.64 mL - 346.36 mL), Cohen's d 0,13 in (Table II). Paired T-test analysis showed there was a difference in the average increase in breast milk production volume pre-post test DPP p<0.005 in mothers aged 20 - ≥30 years (Table III). Wilcoxon analysis showed a difference in the average increase in breast milk production volume pre-post test DPP (p<0.001) in primipara and multipara (Table IV).

Table I: Frequency Distribution of Breastfeeding Mothers at Samarinda Clinic

Characteristic	Frequency (n)	Percentage (%)
Age		
1. 20 - 29	24	80
2. ≥ 30	6	20
Parity		
1. Primipara	19	63,3
2. Multipara	11	36,7

Note: The data were analyzed using a descriptive test with frequencies and percentages of data.

Table II: Distribution of breast milk production

Variables	Pretest		Posttest		Effect Size
	Mean ± SD		Mean ± SD		Cohen's d
Age					
20 – 29 Years	265.83	87.935	288.33	94.468	0,124187
≥ 30 Years	288.33	86,297	378.33	83.748	0.105842
Parity					
Primipara	285.79	87.86	397.89	94.85	0.122629
Multipara	243.64	81,83	346.36	77.96	0.128542

Note: The analysis of data showed the meanstandard deviation, and effect size of breastmilk production in the age and parity before and after the Double Power Pumps (DPP).

Table III: Differences in pre-post-test breastmilk volume at the age of 20 - ≥ 30 years

	Pre–Test Vs Post-Test							
	Mean	SD	SE	CI Lower	CI Upper	t	df	P value
Pre-Test (ml)	-242.933	89.077	16.263	-276.195	-209.671	-14.938	29	.000
Post Test (ml)	-351.6	94.015	17.165	-386.706	-316.494	-20.484	29	.000

Note: Analysis of pre-post test data for breast milk volume with double power pumps (DPP) intervention using paired T-test at age 20 - ≥30 years, significance p value <0.001.

Table IV: Differential pre-post test breast milk volume at parity

		N	Mean Rank	Sum Of Rank
Post-test (mL) – Pre-test (mL)	Negative Ranks	0[a]	.00	.00
	Positive Ranks	30[b]	15.50	465.00
	Ties	0[c]		
	Total	30		

a. Breast milk volume posttest (mL) < Breast milk volume pretest (mL)
b. Breast milk volume posttest (mL) > Breast milk volume pretest (mL)
c. Breast milk volume Posttest (mL) = Breast milk volume Pretest (mL)

Test Statistics[a]

	Post-test Breast milk volume (mL) – Pre-test Breast milk volume (mL)
Z	-4.790b
Asymp. Sig. (2-tailed)	.000

a. Wilcoxon Signed Ranks Test
b. Based on negative ranks.

Note: Analysis of pre-post test data of breast milk volume with double power pump (DPP) intervention in primipara and multipara, negative value 0.00, positive value 465.00, and p-value <0.001.

DISCUSSION

The results of the study on postpartum mothers' intention to use a breast pump immediately after delivery suggest that there is a need for improved lactation support and to reduce concerns about inadequate milk supply in the immediate postpartum period (3). The success of early lactation is strongly influenced by parity, but can also be influenced by modifying factors such as medications (14). Frequent and regular breastfeeding ensures the breasts are emptied, increasing milk production and maintaining milk supply (8). Lactation support for early breastfeeding initiation is more effective than exclusive pumping (15). The measures of breastmilk adequacy are the amount of breast tissue differentiation, hormone levels, and effective and regular milk production (2). Breast tissue differentiation is affected by age. Extended breastfeeding may enhance breast tissue differentiation and reduce breast cancer risk, particularly in older women (16). Breastmilk production is highest in mothers aged 20-30, with an optimal capacity of over 50%, while mothers over 30 also produce well (5). Research indicates no reduction in breastmilk production with maternal age (15-42 years), averaging 750-800 mL (1). During pregnancy, higher hormone levels expand the ductal system and enlarge the breast epithelium. If breastfeeding stops, the glandular tissue function declines, but there's no significant reduction. With age, breast lobules undergo involution, decreasing alveoli and replacing mammary glands with fatty tissue (17).

The results indicated that age and parity influenced exclusive breastfeeding (EBF) initiation, with first-time mothers aged ≥35 showing the strongest association with failure to initiate EBF. This suggests that older primiparas are at greater risk of not starting EBF (14). The association between parity and timing of breastmilk release, breastfeeding, and factors affecting breastfeeding showed primipara had a higher relative risk (RR=2.62; 95% CI: 1.35-5.10) of hesitancy to breastfeed after discharge than multipara (18). Lactation is a series of physiological responses that are closely linked to the hormones prolactin and oxytocin (5,9). A pumping pattern that mimics a baby's suction can provide maximum results (5,9,19). Breast milk production begins with nipple stimulation, which releases oxytocin to trigger contractions in the myoepithelium of the alveolus and pushes the milk to the lactiferous glands, where it flows through the baby's suction or breast pump (5,8,20). Frequent and effective breastfeeding is crucial for maintaining milk production, which remains stable for the first 6 months in exclusively breastfeeding mothers, supported by good interaction with the baby and breast anatomy (5,21). Postpartum mothers who breastfeed early are 2.73 times more likely to produce more breastmilk. Mothers breastfeeding 8 or more times a day are 4.27 times more likely to produce more milk than those breastfeeding less than 8 times (8). Most primipara and multipara pump breastmilk 6 weeks postpartum before separating from the baby (3).

Results showed that parity, infant sex, and birth weight did not significantly affect breastmilk production, while early initiation, frequency, and duration of breastfeeding positively impacted it (5,19). Pumping breastmilk is common for breastfeeding mothers. To boost milk supply, mothers should optimize breastfeeding frequency (19). Breast milk can increase by 15-40% when expressed with a pump after breastfeeding (11). Breastmilk production during breastfeeding depends on the positive pressure of breastmilk ejection and the negative pressure of infant suckling (9). The natural pattern of breastmilk production from day 6 to day 42 depends on the baby's sucking (23). Efficient and comfortable pumping is essential for establishing and maintaining lactation, as changes in breastmilk production patterns can increase pumping effort (9). The breastfeeding mothers who pumped only had a mean duration of 56 days and could stop producing milk (p=2.6-5.4). Comparison of groups of mothers who only pumped breastmilk showed a shorter duration of breastmilk production (15). The pumping-only group also had a shorter breastfeeding duration (p 2.0-4). The pumping and direct breastfeeding groups had an average duration of breastmilk production of 228 days, with 170 days of pumping. This suggests that just pumping can lead to shorter overall milk production (15).

CONCLUSIONS

The DPP intervention led to increased breastmilk production in breastfeeding mothers aged 20 - ≥30 years, both primipara and multipara. When done correctly and consistently, DPP can supply breast milk needs, while direct breastfeeding and pumping breast milk can prolong the duration of breast milk production and extend the breastfeeding phase.

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