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# The effectiveness of moringa leaf jelly on mother's prolactin level and baby's outcome

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**ABSTRACT**

The failure of exclusive breastfeeding and the increased use of milk formulas is one of the results of a shortage of breast milk production. Moringa leaf contains phytosterol to increase milk production. Fortification of moringa leaf with jelly will increase the nutritional value of moringa leaf so that the prolactin increases and the production and quality of breast milk get better for babies. This study aimed to determine the effect of moringa leaf jelly on increasing milk production (prolactin, breast milk volume), and the outcome for the baby. Quasi-experimental research using pre-postest with control group design. The study respondents were taken with a purposive sampling technique of 58 people. Outcome indicators for babies are seen from the baby's weight, the baby's urination frequency, the baby's defecation, and the baby's sleep duration. There was a significant effect on the increase in prolactin score by 23.3%, breast milk volume by 47%, and outcome babies by 3.3% in respondents given moringa leaf jelly. Meanwhile, respondents who were not given Moringa leaf jelly had a risk of decreasing prolactin levels 10.5 times, breast milk supply was 3.8 times lower and the outcomes for babies were 15 than those given Moringa leaf jelly. The moringa leaf jelly significantly effects increasing milk production and outcomes for babies compared to standard interventions.



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## 1. INTRODUCTION

Breast milk is the right of every baby; incredibly exclusive breastfeeding because it is the *starting point for* healthy children in the world. Breast milk is a central nutritional point that can reduce the progressive impact of *stunting*, and whose number of cases is increasing [1]. Breastfeeding can save 900 lives annually if 90% of mothers exclusively breastfeed for six months [2]. According to UNICEF *(United Nations Children's Fund*, the probability of infant mortality in the first month of birth is 25 times higher for whom do not get exclusive breastfeeding or infants who consume baby formula [3]. The benefits of breast milk can reduce pneumonia by up to four times, reduce diarrhea by 47%, reduce the risk of pediatric cancer and colon cancer, and reduce otitis media by 23%, asthma, and attention deficit hyperactivity disorder (ADHD) compared to infants fed baby formula [2].

Fatty acids found in breast milk are essential elements in cell membranes, and highly concentrated docosahexaenoic acid serves to develop the brain. Babies exclusively breastfed until the age of one year can improve cognitive development at school age. The advantages of breast milk can not only be felt by babies but also by mothers who breastfeed; among the benefits for mothers are that it can reduce Alzheimer, bleeding, anemia, natural contraceptives, cervical cancer, ovarian cancer, breast cancer, reducing child neglect, hypertensive obesity, and diabetes mellitus [4].

About 63% of women stop breastfeeding during the first few weeks of the puerperium because they feel that breast milk production is insufficient for their baby's needs [5]. Lactation failure has severe repercussions for the baby, such as reduced caloric intake, dehydration, hypernatremia, and hyperbilirubinemia, in the first days of life. Basic Health Research data in Indonesia shows that exclusive breastfeeding for babies up to 6 months is only 38% [6]. Many factors affect breast milk production, and one of the main factors is the prolactin hormone [4]. Prolactin hormones are significantly reduced from 3 weeks and three months postpartum [1]. Therefore, in the first two weeks, mothers must maintain quality food to produce sufficient breast milk. Aside from the quality, the quantity of breastfeeding also affects the increase in the production of breast milk. Formula feeding alternately with breast milk can lead to reduced breast milk production [7]. The lack of stimulation of the hormones prolactin and oxytocin can decrease the production and secretion of breast milk, especially on the first day of birth [8]. The main success factor in exclusive breastfeeding is the sufficient volume of breast milk production. This will also have an impact on the baby, namely increasing the baby's weight, the frequency of defecation and urination of the baby and effectively increasing the duration of the baby's sleep [9].

A nonpharmacological natural intervention to increase breast milk production and minimize the risk obtained for both mothers and babies is moringa [10]. Moringa contains nutrients like calcium, potassium, iron, protein, vitamins A, B, and C, minerals, and a full range of essential amino acids [11]. The high content of vitamins and minerals in moringa leaf jelly can reduce deoxyribo nucleic acid (DNA) damage and affect breast milk quality, which is vital for infant nutrition [9]. Phytosterols (included in the classification of steroids), alkaloids, saponins, flavonoids campesterol, stigmasterol, and β-sitosterol are comprehensively important for producing breast milk [12]. Phytosterols stimulate a part of the rhetorical cell on the breast glands so that breast milk production increases. Moringa leaf jelly contains compounds that have been shown to have lactogenic properties, including certain steroids and flavonoids. The steroid content in moringa leaf jelly can affect the increase in breast milk levels of breastfeeding mothers.

These compounds are thought to act directly on the mammary glands to stimulate milk production, as well as indirectly by increasing prolactin levels [13]. The safe dose of moringa leaf extract does not exceed 250 g per day. The processing of moringa leaf by boiling and making jelly will reduce the high fiber content so that it inhibits the decomposition of protein and iron can increase. This increase in protein content increases maternal immunity and facilitates the absorption of phytosterols contained in moringa leaves. Fortification of moringa leaves together with jelly will increase the nutritional value of moringa leaves consumed by postpartum mothers [14]. In addition, moringa leaves are easy to get for breastfeeding mothers in Asia and can be made yourself. Based on the previous discussion, research on moringa leaf agar is the first study conducted on humans, after its effect on alveolar enlargement in experimental animals. This study aimed to discuss the effect of moringa leaf jelly on breast milk production for breastfeeding mothers (prolactin, breast milk volume) and the outcome for the baby.

## 2. METHOD

This study is quasi-experimental with a pre-posttest design and a control group. The samples of this study were the entire breastfeeding mothers on days 1-3 postpartum who gave birth at the independent midwife practice in Jadimulyo Village. The research sample was willing to become respondents by filling out a consent form after being explained. Inclusion criteria encompassed i) postpartum mothers on days 1-3, ii) mothers giving birth typically (without surgery), iii) not giving baby formula; iv) infant body weight in 2,500–4,000 grams; v) normal baby's sucking reflex; vi) maternal age of 20–35 years; vii) the shape of the nipples on both breasts protrudes; viii) Mothers who did not smoke and consume alcohol; and ix) Mothers who did not consume herbs. Exclusion criteria were i) Postpartum mothers with breastfeeding contraindications, such as HIV, and chemotherapy drugs, ii) Mentally ill mothers or postpartum depression, iii) Mothers who stopped breastfeeding during the study for any reason, iv) Mothers who ran complementary therapy. Meanwhile, the samples that were declared to be dropped out were: i) Mothers who ate moringa leaf jelly only once a day or did not spend 250 g (twice a day) or exceeded the dose (more than three times a day), ii) Mothers who fed other than breast milk during the process of the study, iii) Mothers who were allergic to moringa leaf jelly.

Examining the hypotheses of this study used 2-tailed. Group selection was carried out by purposive sampling carried out according to the first birth. Sample calculation uses G*Power and on previous studies due to the exact characteristics of the research sample [7], [10]. The 58 respondents met the inclusion and exclusion criteria and were divided into 29 groups of research treatment and 29 groups of research control. The odd groups (1,3,5 and so on) were the groups of the research treatment, and the even groups (2,4,6 and so on) were the groups of the research control. During the research, the data monitoring committee did not monitor the study since it was conducted with minimal risk and lasted for a short duration. No side effect was

found during the examination from postpartum mothers who consumed moringa leaf jelly and the babies. The way to control potential confounding variables in this study is by multivariate analysis with Analysis of Variance (ANOVA).

### 2.1. Instrument

Validity and reliability tests refer to previous journals according to four instruments assessment criteria. Four instruments used in this study were:

a) General characteristics of respondents include maternal age, obstetric history, gestational age, history of childbirth, newborn weight, gestational age, baby sex, and frequency of breastfeeding.
b) Primary data, such as examining prolactin, were measured with Enzyme-Linked Immunosorbent Assay. Researchers did venous blood of breastfeeding mothers three times; before the intervention, day 3, and day 7 (postpartum). The basis for measuring the volume of breast milk and Prolactin levels was on day three and day 7, presenting lactogenesis on stage II and stage III [15].
c) The checklist on the volume of breast milk volume was assessed in pre-consuming and post-consuming Moringa leaf jelly. Breast milk production volume was measured twice, before and after treatment, in each group on day three and day 7. Researchers had mothers pump their breasts 15 minutes before they breastfed their babies. One gram volume of breast milk =1 ml. This measurement method corresponds to the volume of breast milk based on the dilution of deuterium oxide in previous studies [16], [17]. Meanwhile, the fullness of the breasts is judged from the average fullness of the breasts in the first 1 hour of the mother giving birth. Respondents were also asked whether they felt their breasts felt heavy or complete and when do you feel them whole. Also, side effects were asked on day three and day eight after Moringa leaf jelly administration.
d) The baby outcomes indicators, namely sleep duration, were measured using a brief sleep questionnaire (BISQ). Baby weighing used the electronic scales ((Zepper EB-20), accurately to 5 g) over 24 hours, conducted on days 1, 3, and 8 postpartum. Baby clothes were removed while measuring to have resulted in the standard of the baby's weight. Baby's weight, sleep duration, frequency of defecation, and urination per day in babies are calculated after breastfeeding. The duration of the baby's sleep after breastfeeding, the frequency of defecation, and urination per day on babies were recorded in the observation sheet [18], [19].

### 2.2. Intervention

All mothers were given lactation management counseling (standard postpartum care) by the Independent Midwife Practice. In the research control group, only lactation management counseling and common jelly with the color of grass jelly were given; in the group research treatment, Moringa jelly was given. Researchers observed that respondents breastfed with the correct technique and had initiated early breastfeeding for approximately one hour. Mothers breastfeed directly through the breast without milking aids and pacifiers. Respondents (nursing mothers) on the questionnaire were given questions according to the inclusion criteria. Respondents were initially given moringa jelly six hours after giving birth and ate thrice daily for eight days. Moringa leaf jelly is given at 08.30 and 16.30. Random group selection means that neither the intervention provider nor the intervention participants knew whether the jelly contained moringa leaf jelly or a placebo (grass jelly). Moringa leaf jelly was composed of 3 tablespoons of sugar, and the original flavor was boiled with 10 gr blended moringa leaf jelly. A dose of 10 grams of moringa leaf jelly (2 handfuls) was according to the research dose of the galactagogue plant [20], [21]. Fresh grass jelly leaves were used in the placebo group so that there was no visible difference in the moringa leaf jelly or grass jelly given to the respondents. After it was prepared, the nursing mothers saved the food in the refrigerator to be consumed twice daily. The research stages were described in the following discussion:

a) Respondents filled out a demography questionnaire to determine respondents' characteristics in both the treatment and control groups.
b) On the first day of feeding, the mother had her blood drawn from a vein before being given treatment. After that, the mother's vein blood was taken on the third and eighth days; after 2 hours, the mother consumed moringa leaf jelly. Blood was taken using a 3cc syringe and a G24 wing needle on a three-cc vena median cubiti. Blood is stored in oxalate tubes and centrifuge, then in a refrigerator with a temperature of $-18^0$C. The blood was stored in the laboratory of Pingsewu Hospital Lampung. Then the samples are sent to the Biomedical Laboratory of the Faculty of Medicine, Indonesia's university using dry ice and through aircraft accommodation for approximately two hours. Prolactin examination measurements were carried out with enzyme-linked immunosorbent assay.
c) The increase in breast milk production was measured by measuring the volume of breast milk on days 1, 3, and 8 before treatment and two hours after treatments using breast pump. The results measured that the average breast milk volume in a day was obtained through pumping breasts and multiplied by the relative frequency of breastfeeding in a day resulted in eight times. Subjects filled out the breastfeeding control

sheet and were asked when they felt breast fullness. On average, breast milk was obtained by dividing the volume on days 1, 3, and 8 by dividing by three [15]. The volume of breast milk was then categorized into two, according to the former research [22]. i) It is optimal if the volume of breast milk production is≥ 440 ml per day. ii) Sub-optimal if the volume of breast milk production was <440 ml per day.

d) Measuring the production of breast milk was seen by the baby's weight after breastfeeding, the duration of the baby's sleep after breastfeeding, and the frequency of defecation and urination per day [23], [24]. Researchers observed and interviewed directly to baby's mothers according to the guidelines the experts had validated (nutritionists, a midwife under a certified breastfeeding counselor, and an obstetrician lecturer with expertise in postpartum and breastfeeding care).

### 2.3. Data collection

This research was conducted in July-November 2019 in Jadimulyo Village, East Lampung. The sampling technique is purposive sampling. Three researchers and three enumerators conducted the study. Enumerators were trained before collecting data. Researchers made Moringa leaf jelly and placebo and divided the treatment and control groups according to inclusion criteria. Researchers draw blood from a vein and store it. Laboratory personnel checked Prolactin levels. Researchers collected data on breast milk volume and the smoothness of milk production in the treatment group dan control group. Enuremators assisted in initiating early breastfeeding, and the researchers provided counseling on the correct technique in both groups. Researchers made an appointment with respondents on the schedule of taking blood specimens, measurement of breast milk volume, and the smoothness of breast milk production.

### 2.4. Data analysis

The instrument used is a questionnaire with a validity test using product moment and Cronbach Alpha. The calculation results of the questionnaire reliability coefficient on the volume of breast milk volume ≥0.7 (0.763). Prolactin and breast milk volume were used as the basis of previous studies. Data analysis using IBM SPSS version 18 (SPSS: An IBM Company, New York, USA). This study used a double-sided test. Characteristic Data tested with Chi-square and Mann-Whitney Test. Bivariate groups such as increased Prolactin, breast milk volume, and smoothness of breast milk production used the Wilcoxon test, the Mann Whitney test, and the Independent T-Test, Paired t-test, and ANOVA to compare pre and post-test in the treatment group and the control group. Meanwhile, to test the risk value if you do not give moringa leaf jelly using Chi-square.

### 2.5. Ethical considerations

This experiment received a research permit from Health Research Committee University of Indonesia with the number: 010/KEPK/FKes/2019. All respondents of both treatment and control groups were provided with information about the purpose of the study, the procedures to be carried out, the side effects to be felt, and the name and privacy of the respondents were kept confidential. Both response groups were also asked to sign approval sheets before inclusion criteria were made.

## 3. RESULTS AND DISCUSSION

### 3.1. Results

#### 3.1.1. Characteristics of the respondents

The study result of respondent characteristics was no significant difference in both groups. Therefore, it can be concluded that the respondents of the study were homogenous in age (0.542), education (0.422), work (0.416), gravida (0.414), parity (0.413), total weight gain (0.231), baby gender (0.651), baby's birth weight (0.622), and breastfeeding frequency (0.238). Table 1 shows that the respondents of the study in the treatment and control groups mainly were 26 years old mothers, housewives, low levels of education, multigravida, multiparities, inclined weight on 13-14 kg, GA at 37-38 weeks delivery, female gender, baby's birth weight on 3,052-3,125 gr, and the frequency of breastfeeding in 8-9 times a day.

Table 1. Demographics characteristics of respondents

| Characteristics | Treatment (n=29) | Control (n=29) | p-value |
|---|---|---|---|
| Mother's age (years) | 26.1 (6.5) | 26.8 (6.5) | 0.542** |
| Working status | | | |
| Working | 11 (37.9%) | 12 (41.4%) | 0.422* |
| Household mother | 18 (62.1%) | 17 (58.6%) | |
| Education | | | |
| Basic | 14 (48.3%) | 12 (41.4%) | 0.416* |
| Senior high school | 10 (34.5%) | 10 (34.5%) | |
| University | 5 (17.2) | 7 (24.1%) | |
| Gravida | | | 0.414* |
| Primigravida | 11(34.4%) | 11(34.4%) | |
| Multigravida | 18(56.3%) | 18(56.3%) | |
| Parity | | | 0.413* |
| Primiparity | 11 (37.9%) | 10 (34.5%) | |
| Multiparities | 18 (62.1%) | 19 (65.5%) | |
| Total weight gain (kgs) | 13.32 (10.2) | 14.43(9,9) | 0.231** |
| GA at delivery (weeks) | 38.53 (0.8) | 37.28 (0.45) | 0.521** |
| Baby gender | | | 0.651 |
| Male | 14 (48.3%) | 13 (44.8%) | |
| Female | 15 (51.7%) | 16 (55.2%) | |
| Birth weight (grams) | 3125.26 (320.12) | 3052.28 (252.03) | 0.622** |
| Breastfeeding frequency (per day) | 9.19 (1.25) | 8.69 (0.928) | 0.238** |

Source: * Chi-square test, **Mann-Whitney

### 3.1.2. Disparities in the levels of Prolactin score and breast milk volume in the treatment and control groups (Pre and Post)

The score Table 2 shows a significant difference between groups that were given Moringa leaf jelly (treatment) and placebo jelly (control) in the prolactin and breast milk volume, p<0.001 (<0.05). In addition, there was an inclined prolactin score of 23.3% in the treatment groups and the score of breast milk volume of 47%. While in the control groups, the prolactin score increased by 0.4%, and the score of breast milk volume inclined by 42%.

Table 2. Disparities in the levels of prolactin score and breast milk volume

| Variable | Group | | | | p-value |
|---|---|---|---|---|---|
| | Treatment | | Control | | |
| | Pre-test | Post-test | Pre-test | Post-test | |
| a. Prolactin | | | | | |
| Mean (SD) | 187.26 (76.56) | 268 (60.06) | 167.23(72) | 180 (76) | <0.001** |
| Interval | 95-247 | 163-343 | 54.78-270 | 96-282 | |
| | p<0.001* | p=0.02* | | | |
| Enhancement (%) | 23.3 | | 0.4 | | |
| b. Breast milk volume (ml) three day | | | | | |
| Mean (SD) | | | | | <0.001** |
| Interval | 2.45 (1.2) | 162.45 (38.9) | 2.8 (1.8) | 102.7(15.4) | |
| | 1-6 | 106-183 | 1-8 | 96-150 | |
| | p<0.001* | p<0.001* | | | |
| Enhancement (%) | 47 | | 32 | | |

*Source: *Wilcoxon, **Mann-Whitney*

### 3.1.3. Enhancement of Baby's weight, Baby's urinary, Baby's defecation, and Baby's length of sleep

According to Table 3, there was an increase in the baby's weight by 628.95 grams, the frequency of the baby's urinary by 5.49 times, the baby's defecation by 3.3 times, and the baby's length of sleep by 3.31 hours. In addition, Table 3 shows that, in the treatment group, there was a significant increase in the score of the smoothness of breast milk production, which was seen from the indicator of the baby's weight, the frequency of the baby's urination, the baby's defecation, and the baby's sleep duration, p<0.001 (p<0.05).

Table 4. The relative risk (RR) score on prolactin was 10.5 with IK 95%, which means that groups with no moringa leaf jelly met a risk of declined prolactin (low prolactin levels) compared to the treatment groups. The groups with the volume of breast milk production were RR by 3.8 with IK 95%, which means that groups with no moringa leaf jelly had a risk of decreasing breast milk production volume by 3.8 compared to the treatment groups. Meanwhile, in the groups with babies outcome, RR was 15, which means that groups with no moringa leaf jelly met a risk of losing weight, defecation, urinary and sleep duration

Table 3. The discrepancies of score outcome babies in the treatment and control groups

| Variable outcome babies | Group | | p-value |
|---|---|---|---|
| | Treatment Mean (SD) | Control Mean (SD) | |
| a. Baby's weight | | | <0.001** |
| Pre | 3125.26 (320.12) | 3052.28 (252.03) | |
| Post 1 | 3205.18 (361.08) | 3081.24 (254.45) | |
| Post 2 | 3321.24 (351.34) | 3124.01 (256.35) | |
| Post 3 | 3754.21 (340.23) | 3225.73 (265.23) | |
| The difference in the increase | 628.95 (20.11) | 173.45 (13,2) | |
| Pre-Post 3 | p<0.001 | p=0.002 | |
| b. Baby's urinary | | | <0.001** |
| Pre | 3.72 (2.26) | 3.04 (1.44) | |
| Post 1 | 4.48 (2.87) | 2.52 (1.13) | |
| Post 2 | 5.57 (2.93) | 3.25 (2.11) | |
| Post 3 | 9.21 (3.2) | 7.78 (2.43) | |
| The difference in the increase | 5.49 (0.94) | 4.74 (0.1) | |
| Pre-Post 3 | p<0.001* | p<0.001* | |
| c. Baby's defecation | | | <0.001** |
| Pre | 1.67 (0.71) | 1.54 (0.62) | |
| Post 1 | 2.58 (1.98) | 1.69 (1.08) | |
| Post 2 | 3.53 (2.2) | 2.24 (1.2) | |
| Post 3 | 4.97 (2.4) | 3.78 (1.52) | |
| The difference in the increase | 3.3 (1.69) | 2.2 (0.9) | |
| Pre-Post 3 | p<0.001* | p=0.001* | |
| d. Baby's length of sleep | | | |
| Pre | 14.38 (0.4) | 14.56 (0.52) | |
| Post 1 | 15.78 (0.56) | 15.02 (0.48) | |
| Post 2 | 16.2 (0.7) | 15.45 (0.56) | |
| Post 3 | 17.69 (0.89) | 16.25 (0.72) | |
| The difference in the increase | 3.31 (0.49) | 1.69 (0.2) | |
| Pre-Post 3 | p<0.001* | p=0.04* | |
| Enhancement (%) | 3.3*** | 1.2*** | |

*Source: *paired t-test ** independent t-test, ***ANOVA.*

Table 4. The effectiveness of moringa leaf jelly on mother's prolactin, volume, and baby's outcome

| Variable | Nilai p-vule | RR (IK 95%) |
|---|---|---|
| Prolactin | <0.001 | 10.5 (4.01-26.2)* |
| The volume of breast milk | <0.001 | 3.8 (1.98-5.32)* |
| Babies outcome | <0.001 | 15 (3.2-70.3)* |

Source: **Chi-square test*

### 3.2. Discussion

This study showed that giving moringa leaf jelly can increase prolactin, breast milk volume, and baby's outcomes. The hormones that affected breast milk production were oxytocin and prolactin. Giving moringa leaf jelly in food and beverages was believed to increase breast milk production. This can be seen from the smoothness of breast milk production. Moringa leaf jelly contains galactagogues to increase the volume of breast milk production [25]. The result shows, a significant difference in prolactin levels before and after treatment by the score p<0.001. The increase in breast milk production in the group with Moringa leaf jelly was sufficiently meaningful (23.3%). The previous study proved that the lactogenic effect of Moringa leaf jelly was the factor of induction of prolactin production in the anterior pituitary gland. The study as shown in Table 4 reporting prolactin levels showed that mothers consuming Moringa leaf had the highest prolactin levels by the average significant increase. In addition, Table 4 shows the score p<0.001 with IK 95% and RR =10.5; furthermore, it can be concluded that there was an effect of giving Moringa leaf jelly toward the increase of prolactin, and the group with no given moringa leaf jelly risked on the decrease of prolactin. This is according to previous studies, which showed that food quality consumed by mothers, the quantity of breastfeeding, and psychological state affected prolactin.

The pathophysiology of the prolactin released from the lactotrophs of the anterior pituitary gland in response to baby suction was the primary hormonal signal responsible for the stimulation of the synthesis of milk in the mammary glands [26]. The hormone prolactin will increase and produce breast milk for 30-45 minutes if the breast is empty, and prolactin decreases if the breast is full. The initial surge of prolactin secretion in response to breastfeeding can be quite high, typically around 10-20 times the baseline level, and it lasts for about an hour [22]. Prolactin levels were significantly reduced from three weeks and three months postpartum. The circulation level of prolactin in every mother varies depending on the genetic, psychological

state, breastfeeding frequency, and food quality consumed by mothers. The decrease in prolactin could be prevented by the frequency of breastfeeding, which was mostly carried out and consumed galactagogue, such as moringa leaf jelly [1].

Prolactin secretion is under chronic inhibition exerted by dopamine, released from arcuate nucleus neurons of the hypothalamus into the pituitary portal vein. Pharmacological and non-pharmacological agents can inhibit the synthesis of dopamine, rapidly increasing prolactin secretion or vice versa [26]. The low macro and micro nutrients nursing mothers consume will affect the prolactin hormone [12]. The lactogenic effect of moringa leaf jelly was to be through the mechanism of inducing prolactin production in the anterior pituitary gland. Phytosterols can stimulate the mammary glands' secretory cells, increasing breast milk [11].

The galactagogue compound found in Moringa leaf is proven to be able to increase the hormone prolactin so that breast milk production also increases. The galactagogue compounds in Moringa leaf include phytosterols, phenols, and flavonoids. Phytosterols are vegetables' most abundant natural sterols, especially in the Moringa leaf and Sauropus Androgynus. A type of phytosterol is androstane. Androstan is an androgenic steroid compound resulting from the degradation of the hormones testosterone and dihydrotestosterone in the body. However, some precursor compounds such as pregnenolone, dehydroepiandrosterone, and androstenedione can be converted into various steroid hormones, including sex hormones such as progesterone, estradiol, and testosterone, as well as the hormones cortisol and aldosterone. Steroids and prostaglandins stimulate the anterior and posterior pituitary glands to produce prolactin and oxytocin. Both of these hormones can increase the production and secretion of breast milk [27].

Table 2 shows that the value of $p<0.001$, in breast milk production averaged in lactogenesis II and III. The increase in value in the group with Moringa leaf jelly was 47%, while the group with placebo was only 32%. In addition, the group not given moringa leaf jelly risked a decrease in breast milk production of around 3.8%. According to previous studies, micronutrients consumed by nursing mothers would affect the ability to produce breast milk [12]. Moringa leaf is a local plant widely found and rich in nutrients, including calcium, potassium, iron, protein, vitamin A, B vitamins, vitamin C, minerals, and a complete range of essential amino acids [11]. The supporting values of Moringa leaf jelly are seven times more than the vitamin C in oranges, ten times more than vitamin A in carrots, and twice more than vitamin E in grains, 25 times of spinach iron, 17 times more than milk calcium, 9 times more than yogurt protein, and 15 times more than banana potassium. The high content of vitamins and minerals in moringa leaf jelly can reduce DNA damage and improve the quality of breast milk. At the same time, phytosterol compounds such as alkaloids, saponins, and flavonoids campesterol, stigmasterol, and β-sitosterol can increase breast milk production [12].

High levels of prolactin are essential for producing, prolonging, and facilitating breast milk production in nursing mothers. Moringa leaf jelly contains galactagogue compounds and steroids that can help to increase breast milk production by stimulating the activity of breast gland cells and nervous secretions in the mammary glands. In addition, Moringa leaf jelly contains flavonoid compounds and alkaloids that can help increase breast milk production. Lactagoggum compounds and steroids in Moringa leaf jelly can stimulate protoplasmic activity in the secretion of breast gland cells and stimulate nervus secretion in the mammary glands, which can increase breast milk production in nursing mothers. The process of breast milk production in nursing mothers involves various hormones and biological processes, and the compounds contained in moringa leaf jelly can help increase breast milk production naturally. Moringa leaf jellies are compounds that can activate and stimulate the work of prolactin right on the epithelial cells of the alveoli. In addition, having a galactagogue effect, moringa leaf jelly is rich in vitamin A. Vitamin A serves for interaction with intracellular receptors, which can stimulate the body's epithelial growth, especially the breast epithelium and brain system. In the epithelium of the brain, vitamin A can help the anterior hypophysis produce Prolactin, an essential hormone for breast milk production. While the function of vitamin A in the breast can activate epithelial cells in the alveoli to accommodate breast milk production resulting from the work of prolactin [28]. The hormones estrogen and progesterone will disappear after the birth of the baby. It enhances the pituitary gland's lactogenic effect to aid in breast milk production of breast milk [29]. Nutrients and galactagogue compounds can induce breast milk production. Mothers are expected to consume Moringa leaf jelly and various other nutritional variants daily. The milk production glands must get enough nutrients to work optimally. According to previous studies, the milk that did not come out was caused by poor nutrition, fear, or the mother's mental depression. Because these state can influence the hypothalamus, the anterior secretion of pituitary prolactin decrease leading to lactation decreases [30], [31].

The smoothness of breast milk production from the indicators of babies, according to Table 3. The table also shows that the difference in weight gain, frequency of urination and defecation, and sleep duration in the treatment group was more significant than in the control group. Moringa leaf jelly help increases breast milk production so that the baby's breast milk needs are appropriately met. This leads to a significant increase in the baby's weight, followed by sufficiently good elimination. This aligns with research conducted by Kent *et al.* [32] which states that clinical signs of adequate breast milk production include stable growth, sufficiently good elimination, a baby's alertness, and the fullness and softness of the breasts after

breastfeeding. In addition, babies who get enough breast milk will make their stomachs full and sleep more intensely [32]. Other supporting studies also state that the adequacy of breast milk depends on the production of breast milk and the secretion or smoothness of breast milk given to babies. This can be done if the baby sucks well, the breasts are healthy and can produce breast milk, and the secretion of breast milk is smooth. Furthermore, the indicators that can be seen are the well-sleeping baby and after breastfeeding baby's sleep [33]. In addition, the baby's weight has increased according to the baby's growth chart, more or less five times defecation, and 7-10 times urination. In addition, previous studies also mentioned that the smoothness of breast milk production was examined by babies not losing 10% of the baby's birth weight during the first week of the birth [24]. Weight gain is one gram equivalent to 1 mL of breast milk intake [33].

The positive impact of the sustainability of smoothness of breast milk production and secretion is that the baby is calmer, less fussy, looks alert, satisfied after breastfeeding, and will even fall asleep deeply after breastfeeding. The baby's mouth and eyes will look clean, clear, and fresh, followed by fresh and firm skin. A large amount of breast milk production can meet the needs of a baby's nutrition. The need for sufficient breast milk helps the growth and development of the baby optimally [34]. Babies who are breastfed sufficiently have an ideal weight and will not be obese, especially babies who are exclusively breastfed. Smooth production and secretion of breast milk will impact the success of exclusive breastfeeding. In addition, babies who are given breast milk have sufficient sleep duration according to their age, which leads to the baby's optimal cognitive development. In addition, the nutrients of breast milk are also a factor in improving intelligence. Several studies conducted vocabulary tests on children five years old, and it resulted that children who were breastfed exclusively, in terms of vocabulary, the pattern of the construction, and image equations were much more advanced by 1 to 6 months than children who had never been breastfed [34].

Table 4 also states the group that was not given Moringa leaf jelly had 15 times the risk of losing weight, defecation, urinary and sleep duration compared to the treatment group. This aligns with previous studies that mothers who lack eating and drinking and have fatigue impacts breast milk production, in which the breast milk production is not smooth, the baby's weight indicators are not rising, the baby has insufficient sleep duration of fewer than two hours after breastfeeding, the frequency of defecation is less than three times, and the urination is less than five times. Breast milk production in the first 48 hours is unrelated to subsequent milk production. However, the production of breast milk in lactogenesis II and III, particularly the first two weeks of breastfeeding, is a marker of successful breastfeeding. In addition, early initiation of breastfeeding, quality foods, such as Moringa leaf and Sauropus Androgynus, and the frequency of breastfeeding are the factor that influences the success of breastfeeding, and it can be associated with the results of the 48-hour baby weight [33]. A sort of advantage is obtained for nursing mothers to consume galactagogue, especially moringa leaf jelly. Except for increasing hormone prolactin, the increased production of breast milk is also refreshing and tasteful. Therefore, it is hoped for health workers, especially midwives, to provide counseling on nutritious food and galactagogue for postpartum mothers who are being treated at the Independent Midwife Practice for up to 14 days postpartum. It is expected that postpartum mothers can provide breast milk instead of lacking milk production. A further impact is that exclusive breast milk successfully prevents stunting from continuing to increase in Indonesia.

This study has the strength of comparing the treatment and control groups. The intervention was repeated up to three times, namely on the 1st, 3rd, and 8th postpartum days in both the mother and baby groups. This study also compared the risk of impact if breastfeeding mothers and their babies did not use Moringa leaf jelly. This practice also contributes to discussing the theoretical effectiveness of Moringa leaves to increase prolactin levels, breast milk volume, and outcomes for babies such as increased body weight, frequency of defecation and urination, and duration of baby's sleep. This study also has limitations, namely the small sample size of less than 30 (29 per group). In addition, the sample characteristics in the treatment and control groups used more multiparous mothers. This is due to the limitations of the samples obtained after purposive sampling. In addition, the selection of treatment and control groups was not done randomly, so bias could occur. For future research, it is better if the number of samples per group is more than 30 and all samples are used in the primiparous group so that the results are perfect. This study provides scientific evidence that moringa leaf jelly can be used as an alternative for breastfeeding mothers to increase prolactin levels, breast milk volume, and outcomes for their babies.

## 4. CONCLUSION

This study is quasi-experimental with a pre-posttest design and a control group. This study concludes that Moringa leaf jelly increases prolactin so that the volume and baby outcomes. Baby outcomes are seen from 4 indicators; increasing the baby's weight, increasing the frequency of the baby's defecation and urination, and effectively increasing the duration of the baby's sleep after breastfeeding.This research also proves that respondents who were not given Moringa leaf jelly had a risk of decreasing prolactin levels

10.5 times, and breast milk supply was 15 times lower than those given Moringa leaf jelly. Apart from that, the impact of giving Moringa leaf jelly to breast milk was uneventful.

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