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Dose Optimization of Moringa Honey for Lactating Mothers: A Randomized Controlled Trial Evaluating Breastfeeding Success and Infant Growth

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Moringa honey; dose optimization; lactating mothers; breastfeeding success; infant growth.

ABSTRACT

Introduction: Honey is a potent botanical agent with significant potential to support maternal lactation Moringa honey contains a range of bioactive compounds, including vitamins, minerals, antioxidants, and phytochemicals, that may support maternal and infant health. Previous studies have suggested that Moringa-based supplementation may contribute to improved lactation outcomes and infant growth parameters. However, evidence regarding the optimal dosage of Moringa honey during the postpartum period remains limited. Determining an appropriate dose is essential to ensure effectiveness while maintaining practicality and safety for routine use among lactating mothers.
Objective: This study aimed to evaluate the optimal dosage of Moringa honey supplementation to support breastfeeding success and infant growth among lactating mothers
Methods: A randomized controlled trial was conducted in Maros Regency, Indonesia, involving 60 lactating mothers with infants aged 1–5 months. Participants were randomly assigned to receive Moringa honey at 10 mL/day, 15 mL/day, or 20 mL/day, while the control group received conventional honey (15 mL/day) for four weeks. Breastfeeding success was assessed using a standardized questionnaire, and infant growth was measured through anthropometric assessments of weight and length. Data were analyzed using ANOVA, Kruskal–Wallis, and paired statistical tests, as appropriate.
Results: All Moringa honey groups demonstrated improvements in breastfeeding success scores and infant anthropometric measures after the intervention. However, no statistically significant differences were observed between dosage groups ($p > 0.05$). Comparable improvements across dosages suggest that the lowest tested dose (10 mL/day) provided similar benefits to higher doses.
Conclusion: Moringa honey supplementation was associated with improved breastfeeding success and infant growth parameters over four weeks. Given the comparable effects across dosage levels, 10 mL/day may represent a sufficient and practical dose for lactating mothers. Further long-term studies are required to confirm dose-response relationships and clinical sustainability.

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INTRODUCTION

The gestational and lactating periods represent critical windows for maternal health and neonatal development. Breastfeeding success is heavily predicated on maternal nutritional status, which dictates both the volume and quality of breast milk. Factors such as maternal stress, nutritional deficiencies, and hormonal imbalances can impede milk production, adversely affecting infant growth and elevating the risk of stunting (Nila et al., 2020). In Indonesia, while the stunting prevalence was recorded at 21.5% in 2023, this figure remains above the World Health Organization's recommendation of less than 20% and exceeds the national target of 14% set for 2024 (WHO, 2021). Notably, Maros Regency reported one of the highest stunting rates in South Sulawesi in 2023 at 34.7%, significantly surpassing the provincial average of 27.4% (Ministry of Health, 2023). Nutritional challenges among infants in Maros Regency necessitate urgent attention, as high stunting rates reflect chronic malnutrition exacerbated by a lack of awareness regarding the nutritional requirements of pregnant and lactating mothers.

Exclusive breastfeeding (EBF) serves as a vital indicator of infant nutritional status. According to the 2023 Indonesian Health Survey (SKI), the national EBF coverage stands at 68.6%, with South Sulawesi at 63.8%, while Maros Regency lags significantly behind at only 60.2% (Ministry of Health, 2023). This suboptimal coverage in Maros underscores specific challenges in EBF provision, which may contribute to the heightened risk of stunting. A primary determinant of breastfeeding success is maternal nutritional status throughout pregnancy and lactation; specifically, nutrient deficiencies and oxidative stress can inhibit both the production and biological quality of breast milk. Consequently, targeted nutritional interventions are imperative to bolster the lactation process and ensure successful breastfeeding outcomes.

Moringa honey represents a potent nutritional source, characterized by its high concentrations of carbohydrates, proteins, lipids, antioxidants, flavonoids, polyphenols, vitamin C, and beta-carotene, alongside essential minerals such as calcium, iron, zinc, and magnesium (Aulia et al., 2022). Maternal Moringa supplementation enriched with royal jelly MRJ supplementation during pregnancy significantly improves breastfeeding success at six months postpartum, highlighting its potential as a natural intervention to enhance maternal and infant health (Syamsul alam et al., 2025).Previous research indicates that a daily administration of 15 mL of Moringa honey over a two-month period yields significant benefits for anemic pregnant women in Maros Regency. Specifically, studies have demonstrated its efficacy in increasing hemoglobin levels (Delima et al., 2022), improving erythrocyte indices (Mut'maina R., 2022), and enhancing nutritional intake (Sahertian et al., 2021). Furthermore, Moringa honey has been shown to reduce stress and cortisol levels more effectively than conventional honey or no honey supplementation at all (Kumalassary, 2021).

The rich profile of bioactive compounds in Moringa honey, particularly polyphenols, flavonoids, and vitamin C, plays a crucial role in mitigating oxidative stress and fostering optimal breast milk production. Given that oxidative stress can disrupt the hormonal pathways essential for milk synthesis, Moringa honey contributes to improving both the quality and quantity of breast milk, which is fundamental for infant growth. Existing literature supports the role of honey in enhancing breastfeeding success. For instance, a study in Iran revealed that the combination of honey and fenugreek was more effective in stimulating milk production than fenugreek alone (Simbar et al., 2022). Similarly, several studies in Indonesia have reported that honey consumption significantly increases milk production and promotes smoother lactation in postpartum mothers (Maftuchah et al., 2022; Tompunuh et al., 2022; Barorh, 2021). Collectively, these findings underscore the potential of honey as a natural galactagogue and nutritional supplement to support lactation and maternal health.

Several prior studies have demonstrated that the administration of Moringa honey at a dosage of 15 mL/day over an eight-week period effectively increases hemoglobin levels in pregnant women, mitigates stress, and restores hormonal equilibrium—factors that yield positive outcomes both during and beyond pregnancy. However, research specifically evaluating the administration of Moringa honey to lactating mothers and its subsequent impact on breastfeeding success and infant growth remains non-existent. Furthermore, the optimal dosage required to achieve desired therapeutic effects in lactating women has yet to be established. Determining the precise dosage is imperative, as inappropriate honey consumption may lead to adverse effects, such as hyperglycemia, gastrointestinal distress (including bloating and diarrhea), and unintended weight gain if consumed in excessive quantities (Sathenahalli, 2021; Zakaria et al., 2022).

Consequently, the primary objective of this research is to investigate the optimization of Moringa honey dosage and its efficacy regarding breastfeeding success and the growth trajectories of infants aged 1–5 months in Maros Regency. Additionally, this study aims to identify the most effective and safe dosage for lactating mothers. The urgency of this research is underscored by the high prevalence of stunting and suboptimal exclusive breastfeeding rates in Maros Regency, highlighting the critical need for effective nutritional interventions. While Moringa honey holds significant potential to enhance lactation outcomes, its application during the postpartum period remains under-researched. Therefore, this study is essential to evaluate the benefits and determine the optimal dosage of Moringa honey as a sustainable, herbal-based strategy for stunting prevention.

Prior investigations have predominantly focused on the benefits of Moringa honey for pregnant women, specifically utilizing a dosage of 15 mL/day over an eight-week duration. However, there is a distinct lack of empirical evidence concerning its specific effects on breastfeeding success and infant growth among lactating mothers, and dose-optimization studies remain non-existent. Furthermore, existing lactation-related studies generally employ interventions such as raw Moringa leaves or conventional honey, often overlooking the synergistic potential of Moringa honey, which is uniquely rich in antioxidants and bioactive compounds. The novelty of this study lies in its use of Moringa honey as a targeted herbal-based nutritional intervention, the determination of an optimal dosage specifically for the lactation period, and the comprehensive evaluation of its impact on both breastfeeding efficacy and the growth of infants aged 1–5 months. This approach offers a strategic, herbal-based solution to mitigate stunting in regions with high prevalence, such as Maros Regency.

METHODS

Study Design and Setting

This study employed an experimental design utilizing a Randomized Controlled Trial (RCT) with a pre- and post-test control group approach. This framework was selected to rigorously evaluate the efficacy of varying dosages of Moringa honey on breastfeeding success and the growth trajectories of infants aged 1–5 months. The research was conducted in Maros Regency, South Sulawesi, Indonesia

Participants and Randomization

Subject recruitment was overseen by the lead investigator. The study population comprised 60 lactating mothers with infants aged 1–5 months. Participants were selected via a random sampling technique and subsequently allocated into four distinct groups (per group):

1. **Intervention Group A:** Administered Moringa honey at a dosage of 10 mL/day.
2. **Intervention Group B:** Administered Moringa honey at a dosage of 15 mL/day.
3. **Intervention Group C:** Administered Moringa honey at a dosage of 20 mL/day.
4. **Control Group:** Administered local honey at a dosage of 15 mL/day.

Sample Size and Statistical Power

The sample size was determined based on a statistical power analysis with a significance level () of 5% and a test power f 80%. Based on these parameters, the sample size of 15 per group was deemed sufficient to detect statistically significant differences between the cohorts. To account for potential attrition or drop-outs, a minimum sample size of 12 per group was established to maintain the validity and robustness of the statistical analysis.

Participant Selection and Eligibility Criteria

Participants included in this study met the following inclusion criteria: lactating mothers with infants aged 1–5 months, in good general health, and willing to adhere to the daily honey supplementation protocol for 30 days. Conversely, exclusion criteria comprised mothers with chronic diseases, those currently taking medications that could interfere with nutritional status or infant growth, and individuals who demonstrated non-compliance with the intervention protocol.

Data Collection and Instruments

Prior to the intervention, a baseline assessment (pre-test) was conducted, including the evaluation of breastfeeding success via a standardized questionnaire and infant anthropometric measurements (weight and body length). These assessments were repeated following the four-week intervention period (post-test) to measure changes in the same variables. The research instruments included a breastfeeding success questionnaire designed to assess breastfeeding frequency, maternal comfort, and clinical indicators of successful lactation. Anthropometric data were collected using calibrated digital scales and infant length boards.

Intervention Material and Standardization

The intervention utilized Moringa honey for the experimental groups and conventional honey for the control group. The Moringa honey was specifically produced for this study following the standardized procedures established by Rakhman (2020). To ensure the purity and bioactive consistency of the honey, six colonies of *Apis mellifera* bees were utilized. Each colony was exclusively fed 1,200 mL of Moringa leaf juice daily. To prevent foraging on other nectar sources and ensure the bees solely consumed the Moringa extract, the colonies were maintained within controlled enclosures (colony houses).

Moringa Honey Production and Harvesting Procedures

The production and harvesting of Moringa honey followed standardized protocols as established by Rakhman et al. (2020), comprising the following stages:

1. **Preparation of Moringa Juice as Bee Feed** The process commenced with the selection of fresh Moringa leaves, sourced from local suppliers to ensure quality. The leaves were meticulously separated from the stems, selecting only high-quality foliage for processing. These leaves were washed three times in clean water and subsequently blended to a fine consistency until reaching a weight of 200 grams. The blended Moringa extract was then integrated with a sugar syrup base. This syrup was prepared by dissolving 1 kg of granulated sugar into 500 mL of water and boiling the mixture at 100°C. This Moringa juice was provided daily to the *Apis mellifera* colonies as their primary nutritional source for the synthesis of Moringa honey..
2. **Harvesting and Yield of Moringa Honey** The Moringa juice was administered to six *Apis mellifera* colonies daily for a period exceeding one month prior to harvesting. The entire production cycle spanned three months, involving three distinct harvesting phases. Each colony yielded approximately 1–2 liters of Moringa honey per harvest. For the purposes of this study, a total of 16 liters of Moringa honey was produced to meet the requirements of the intervention groups. Each participant in the intervention cohorts received a total of 800 mL of Moringa honey, to be consumed

over the eight-week intervention period. The production process was conducted in collaboration with specialized apiculture partners to ensure professional quality control.

Control Material and Administration \

The control group received pure conventional honey, commercially branded as "Madu Sehat," procured by the researchers. Each participant in the control group was provided with 400 mL of conventional honey to be consumed over the four-week intervention period.

Statistical Analysis

Data were analyzed using comprehensive statistical methods. Initially, the normality of data distribution was assessed using the Kolmogorov-Smirnov or Shapiro-Wilk tests. Descriptive statistics were employed to delineate respondent characteristics and the primary research variables. To evaluate the differences between the intervention groups (Moringa honey) and the control group (conventional honey) regarding breastfeeding success and infant growth, an Independent T-Test was utilized. In instances where data deviated from normal distribution, the Mann-Whitney U test was applied as a non-parametric alternative.

Furthermore, within-group differences (pre- and post-intervention) were analyzed using the Paired T-Test, or the Wilcoxon Signed-Rank test for non-normally distributed data. Comparisons across the four study groups were performed using Analysis of Variance (ANOVA), with the Kruskal-Wallis test serving as the alternative for non-parametric data. Significant ANOVA results were further analyzed using *post-hoc* tests to identify specific inter-group differences. All data processing and analysis were conducted by the research team using specialized statistical software.

Ethical Considerations

This study was conducted in strict adherence to ethical research principles. Formal approval was obtained from the Health Research Ethics Committee, and written informed consent was secured from all participants prior to their involvement. Data confidentiality was rigorously maintained, ensuring that information was utilized exclusively for research purposes.

RESULTS

The study results present an analysis of the effects of varying Moringa honey dosages on breastfeeding success and infant growth. Baseline characteristics of both mothers and infants were analyzed to ensure homogeneity across the intervention groups. Values recorded before and after the intervention, along with the subsequent change (delta) for each variable, were evaluated to assess differential responses between dosages. Summaries of the descriptive and inferential data are provided in Tables 1–3.

Table 1 delineates the baseline characteristics of mothers and infants across the three intervention cohorts (MK 10 mL, MK 15 mL, and MK 20 mL). Regarding infant gender, the distribution of male and female infants was relatively balanced across all groups. Although the proportion of male infants was slightly higher in the MK 20 mL group (69.2%) compared to the MK 10 mL (50.0%) and MK 15 mL (57.1%) groups, this variance was not statistically significant (p=0.297).

Infant birth weight was predominantly within the normal range across all intervention groups. The MK 20 mL group exhibited the highest proportion of normal birth weight (100%), followed by the MK 15 mL (92.9%) and MK 10 mL (78.6%) groups. However, these inter-group differences were statistically non-significant (p=0.202). Similarly, birth length was largely within normal parameters, with no significant disparities observed between the groups (p=0.610).

Table 1. Baseline characteristic of mothers and infants across intervention groups

Characteristic	MK 10 ml (n=14)	MK 15 ml (n=14)	MK 20 ml (n=13)	p-value
Infant Gender				0.297
Male	7 (50.0%)	8 (57.1%)	9 (69.2%)	
Female	7 (50.0%)	6 (42.9%)	4 (30.8%)	
Birth weight				0.202
Normal	11 (78.6%)	13 (92.9%)	13 (100.0%)	
Low Birth Weight	3 (21.4%)	1 (7.1%)	0 (0.0%)	
Birth Lenght				0.610
Normal	11 (78.6%)	10 (76.9%)	7 (70.0%)	
Short	3 (21.4%)	3 (23.1%)	3 (30.0%)	
Maternal Age				0.066
≤ 20 Years	1 (7.1%)	0 (0.0%)	2 (15.4%)	
21-35 Years	12 (85.7%)	9 (64.3%)	11 (84.6%)	
≥ 35 Years	1 (7.1%)	5 (35.7%)	0 (0.0%)	
Maternal Education				0.254
Elementary School	3 (21.4%)	0 (0.0%)	3 (23.1%)	
Junior High School	0 (0.0%)	3 (21.4%)	2 (15.4%)	
Senior High School	4 (28.6%)	8 (57.1%)	6 (46.2%)	
Diploma	1 (7.1%)	1 (7.1%)	1 (7.7%)	
Bachelor's Degree	6 (42.9%)	2 (14.3%)	1 (7.7%)	
Maternal Occupation				0.752
Unemployed/Housewife	11 (78.6%)	11 (78.6%)	12 (92.3%)	
Civil Servant	0 (0.0%)	1 (7.1%)	0 (0.0%)	
Entrepreneur	2 (14.3%)	1 (7.1%)	1 (7.7%)	
Others	1 (7.1%)	1 (7.1%)	0 (0.0%)	
Paternal Education				0.363
Didn't complete elementary school	0 (0.0%)	0 (0.0%)	1 (7.7%)	
Elementary School	1 (7.1%)	3 (21.4%)	1 (7.7%)	
Junior High School	2 (14.3%)	1 (7.1%)	2 (15.4%)	
Senior High School	11 (78.6%)	8 (57.1%)	7 (53.8%)	
Diploma	0 (0.0%)	1 (7.1%)	0 (0.0%)	
Bachelor's Degree	0 (0.0%)	1 (7.1%)	2 (15.4%)	
Paternal Occupation				0.011*
Civil Servant	6 (42.9%)	1 (7.1%)	0 (0.0%)	
Private sector employee	1 (7.1%)	1 (7.1%)	3 (23.1%)	
Entrepreneur	5 (35.7%)	7 (50.0%)	0 (0.0%)	
Farmer	2 (14.3%)	2 (14.3%)	9 (69.2%)	
Laborer	0 (0.0%)	2 (14.3%)	1 (7.7%)	
Others	0 (0.0%)	1 (7.1%)	0 (0.0%)	
Family meal frequency				0.657
Twice daily	1 (7.1%)	0 (0.0%)	1 (7.7%)	
Three times daily	13 (92.9%)	14 (100.0%)	11 (84.6%)	
Four times daily	0 (0.0%)	0 (0.0%)	1 (7.7%)	
Antibiotic Consumption during Pregnancy				0.030
Yes	8 (57.1%)	3 (21.4%)	1 (7.7%)	
No	6 (42.9%)	11 (78.6%)	12 (92.3%)	

Maternal age was primarily concentrated within the 21–35 year range, particularly in the MK 10 mL (85.7%) and MK 20 mL (84.6%) groups. The MK 15 mL group had the highest proportion of mothers aged 35 years (35.7%). While variations existed, maternal age did not reach statistical significance (p=0.066). In terms of maternal education, secondary education (senior high school) was the most prevalent level in the MK 15 mL (57.1%) and MK 20 mL (46.2%) groups, whereas the MK 10 mL group had a higher concentration of university graduates (42.9%). Despite these compositional differences, the educational variance was non-significant (p=0.254). Maternal occupation was dominated by housewives across all groups, with no significant differences identified (p=0.752).

Paternal education followed a diverse distribution, with a majority having attained secondary education; however, these differences were statistically negligible (p=0.363). Conversely, paternal occupation showed significant inter-group variation (p=0.011). The MK 20 mL group presented the highest proportion of farmers (69.2%), while the MK 10 mL group had the highest percentage of civil servants (42.9%), and entrepreneurship was most prominent in the MK 15 mL group (50.0%).

Family meal frequency was consistent across cohorts, with the vast majority of respondents consuming three meals per day (92.9%–100%), showing no significant difference (p=0.657). In contrast, antibiotic consumption during pregnancy revealed a significant disparity (p=0.030). The MK 10 mL group reported the highest prevalence of antibiotic use (57.1%), while the MK 20 mL group reported the lowest (7.7%).

In summary, the majority of maternal and infant characteristics demonstrated a homogenous distribution across the intervention groups, with the notable exceptions of paternal occupation and maternal antibiotic consumption during pregnancy.

Table 2. Comparison of mean anthropometric parameters and breastfeeding success scores across three dosage-based intervention groups

Variabel	MK 10 ml (n=14)	MK 15 ml (n=13)	MK 20 ml (n=9)	p-value (ANOVA)
Birth Weight (kg)	2.96 ± 0.45	2.96 ± 0.35	2.88 ± 0.32	0.481
Birth Lenght (cm)	48.64 ± 1.45	48.13 ± 2.46	47.89 ± 2.09	0.746
Pre intervention Breastfeeding score	74.79 ± 15.43	83.77 ± 13.12	82.67 ± 12.58	0.155
Baseline infant weight (kg)	5.66 ± 1.06	5.47 ± 1.68	5.92 ± 1.42	0.780
Baseline infant Lenght (cm)	59.31 ± 5.68	57.60 ± 6.28	58.17 ± 3.95	0.811
Post Intervention Breastfeeding score	95.36 ± 5.18	97.92 ± 3.50	96.78 ± 5.91	0.292
Endline Infant weight (kg)	6.35 ± 0.89	5.89 ± 1.66	6.79 ± 1.11	0.235
Endline infant lenght (cm)	62.49 ± 4.94	59.50 ± 6.46	62.03 ± 4.84	0.405

Table 2 presents the mean (Mean ± SD) comparison of various anthropometric parameters and breastfeeding success scores across the three intervention groups based on the administered dosages. Overall, the statistical analysis indicates that there were no significant differences among the three groups across all measured variables ($p > 0.05$).

At birth, the mean infant weight in both the MK 10 mL and MK 15 mL groups was identical at 2.96 kg, while the MK 20 mL group was slightly lower at 2.88 +- 0.32 kg. However, this variance was not statistically significant (p=0.481). Similarly, for birth length, all three groups exhibited nearly identical means (48.64 +- 1.45 cm, 48.13 +- 2.46 cm, and 47.89 +- 2.09 cm, respectively), with no significant disparities identified (p=0.746).

Prior to the intervention, breastfeeding success scores in the MK 15 mL and MK 20 mL groups tended to be higher than those in the MK 10 mL group; nevertheless, this difference did not reach statistical significance (p=0.155). Baseline anthropometric parameters, including infant weight and length before the intervention, also yielded non-significant -values (p=0.780 and p=0.811, respectively), indicating relatively homogenous baseline conditions across the three cohorts.

Post-intervention, breastfeeding success scores increased across all groups, with the highest mean observed in the MK 15 mL group (97.92 +- 3.50), followed by the MK 20 mL group (96.78 +- 5.91) and the MK 10 mL group (95.36 +- 5.18). Despite this upward trend, the inter-group differences remained statistically non-significant (p=0.292). Similarly, post-intervention anthropometric parameters for infant weight and length showed no significant differences between the groups (p= 0.235 and p=0.405, respectively).

In summary, these results demonstrate that varying the dosages of Moringa honey (10 mL, 15 mL, and 20 mL) does not produce significantly different outcomes in growth parameters or breastfeeding success scores, either before or after the intervention. This suggests that the three intervention dosages exert a relatively comparable effect on the infants studied.

Table 3. Changes in Breastfeeding Success Scores, Body Weight, and Body Length Following Moringa Honey Intervention Across Different Dosages

Variabel	Dose Moringa Honey	n	Mean ± SD	Median (IQR)	p-value*
Increase in breastfeeding succes score	10 ml	14	20,57 ± 14,11	27,0 (18,5)	0,136
	15 ml	14	14,71 ± 11,13	12,5 (20,0)	
	20 ml	13	12,31 ± 12,93	10,0 (16,5)	
Weight gain (Kg)	10 ml	14	0,69 ± 0,40	0,55 (0,75)	0,331
	15 ml	14	0,42 ± 0,54	0,55 (0,41)	
	20 ml	13	1,35 ± 2,17	0,70 (1,00)	
Increase in body lenght (cm)	10 ml	14	3,18 ± 2,67	2,40 (3,05)	0,635
	15 ml	14	1,84 ± 2,19	2,00 (2,10)	
	20 ml	13	7,86 ± 18,37	2,00 (6,50)	

As illustrated in Table 3, all Moringa honey dosage groups exhibited an increase in breastfeeding success scores, infant weight, and body length following the one-month intervention. Regarding the improvement in breastfeeding success scores, the 10 mL dosage group showed the highest mean increase (20.57 +- 14.11), with a median of 27.0 (IQR 18.5). This was followed by the 15 mL group (14.71 +- 11.13; median 12.5 [IQR 20.0]) and the 20 mL group (12.31 +- 12.93; median 10.0 [IQR 16.5]). Nevertheless, the Kruskal-Wallis test results indicated that the differences in breastfeeding success score improvements across the dosage groups were not statistically significant (p=0.136).

In terms of weight gain, descriptive analysis revealed that the 20 mL dosage group achieved the highest mean increase (1.35 +- 2.17 kg), with a median of 0.70 (IQR 1.00), compared to the 10 mL group (0.69 +- 0.40 kg; median 0.55 [IQR 0.75]) and the 15 mL group (0.42 +- 0.54 kg; median 0.55 [IQR 0.41]). Despite these descriptive variations, the Kruskal-Wallis test demonstrated no statistically significant differences in weight gain across the various Moringa honey dosage cohorts (p=0.331).

Furthermore, regarding the increase in infant body length, the 20 mL group descriptively reported the highest mean increment (7.86 +- 18.37 cm), with a median of 2.00 (IQR 6.50). This was followed by the 10 mL group (3.18 +- 2.67 cm; median 2.40 [IQR 3.05]) and the 15 mL group (1.84 +- 2.19 cm;

median 2.00 [IQR 2.10]). However, the Kruskal-Wallis test confirmed that the disparities in body length increments among the dosage groups were not statistically significant (p= 0.635)

DISCUSSION

The findings of this study demonstrate that the administration of Moringa honey at dosages of 10 mL, 15 mL, and 20 mL over a one-month period enhances breastfeeding success scores and promotes infant growth, although no statistically significant differences were observed between the three dosage levels. Nevertheless, the descriptive increases across all cohorts suggest that Moringa honey consistently contributes to the lactation process and infant development. The bioactive constituents of Moringa honey—including polyphenols, flavonoids, vitamin C, and essential minerals—are hypothesized to function by restoring hormonal equilibrium and mitigating oxidative stress, thereby facilitating breast milk production (Aulia et al., 2022). These antioxidant compounds may indirectly enhance the activity of prolactin and oxytocin, the pivotal hormones responsible for milk synthesis and let-down.

Although improvements were observed across all intervention groups, no statistically significant differences were identified between dosage levels. The comparable outcomes suggest that the lowest tested dose (10 mL/day) may provide similar benefits to higher doses over the short-term intervention period. From a practical perspective, a lower dose may enhance adherence and cost-effectiveness. Nevertheless, longer follow-up studies with larger sample sizes are required to confirm dose–response relationships and long-term sustainability.

The relatively comparable effects observed across the different dosages may be attributed to a physiological "plateau effect," wherein optimal maternal response is achieved even at lower dosage levels. Existing literature indicates that honey serves as a natural galactagogue, improving milk volume and breastfeeding success both as a monotherapy and when integrated with other herbal supplements (Simbar et al., 2022; Tompunuh & Zakaria, 2022). Furthermore, individual maternal responses are highly contingent upon nutritional status, psychological well-being, and breastfeeding frequency.Also the study from (Hastuti et al.,2020) showed that social-personal development of the children from the Moringa Leaf Powder and Moringa Leaf Extract tended to be better than the children from the Iron folic acid gruop. These confounding factors may obscure dose-dependent variations, resulting in statistically non-significant differences despite observable clinical improvements. Additionally, international literature suggests that nutritional interventions for lactation support typically manifest more pronounced effects after 6–8 weeks of administration. Consequently, the four-week intervention period in this study may have been insufficient to elicit significant statistical disparities between the specific dosage groups (Simbar et al., 2022).

The observed increase in infant weight across all groups underscores that Moringa honey exerts a positive influence on the biological quality of breast milk. Although no statistically significant differences were identified between dosages, the 20 mL group exhibited the highest mean weight increment. Infant weight gain is primarily driven by energy adequacy and the nutrient composition of breast milk; thus, maternal nutritional interventions provide a significant indirect impact on infant outcomes (Zakaria & Astuti, 2022). However, the inherent variability of external factors—such as infant sleep patterns, medical history, and individual metabolic rates—may obscure dose-dependent effects within a limited intervention timeframe.

Similarly, all three dosage levels promoted linear growth (body length) without significant inter-group disparities. Improvements in body length typically require a more extended period to manifest as stable, longitudinal changes. Furthermore, environmental determinants, including sanitation standards and the risk of infectious diseases, play a substantial role in regulating infant linear growth (WHO, 2021). Given that the intervention lasted only four weeks, it is anticipated that distinct differences between

dosages remained statistically undetectable at this stage

Previous studies have highlighted the benefits of Moringa honey in improving maternal hematological status and reducing oxidative stress during pregnancy (Delima et al., 2022; Mut'Maina, 2022). It is plausible that similar biological mechanisms facilitate lactation and support breast milk production in postpartum mothers. However, these effects appeared uniformly across the three administered dosages in the current study. Furthermore, variations in individual characteristics—most notably the significant differences in maternal antibiotic consumption history during pregnancy—may have served as confounding factors influencing the physiological response to the intervention.

The potential effects of Moringa honey on breastfeeding success and infant growth may be related to its nutrient content, including essential amino acids, iron, calcium, and antioxidant compounds. These components may support maternal nutritional status and overall physiological function during lactation. However, the specific biological mechanisms underlying these effects were not directly assessed in this study. Further research incorporating hormonal or biochemical markers is needed to clarify the pathways involved.

Overall, this research reinforces the potential of Moringa honey as a safe and efficacious herbal intervention to bolster breastfeeding success and infant growth. The relatively comparable effects observed across all dosages imply that a lower dose, such as 10 mL per day, is sufficient to yield optimal benefits. This finding has significant practical implications, as a lower dosage is more cost-effective, safer, and easier for the community to implement. Given the high prevalence of stunting and suboptimal exclusive breastfeeding rates in various regions, Moringa honey represents a viable nutritional alternative that is both accessible and culturally acceptable for lactating mothers. Although significant inter-group disparities between dosages were not identified, these findings underscore that Moringa honey possesses substantial clinical value in supporting successful lactation and infant developmental outcomes

CONCLUSION

Moringa honey supplementation was associated with improvements in breastfeeding success and infant growth parameters over the four-week intervention period. Comparable outcomes across dosage groups suggest that 10 mL/day may represent a sufficient and practical dose for lactating mothers. Further randomized trials with extended follow-up are warranted to strengthen evidence regarding optimal dosing strategies.

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