**ORIGINAL RESEARCH ARTICLE**

# Effects of *Moringa oleifera* on increasing breast milk in breastfeeding mothers with stunting toddlers in rural Batang-Batang District, Indonesia

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## Abstract

Stunting in toddlers (0-2 years) remains a significant public health problem in Indonesia. Adequate breastfeeding is essential for stunting prevention, yet many mothers struggle with insufficient milk production. *Moringa oleifera*, known locally as moringa, has traditionally been used to increase breast milk production. Moringa plants have the potential to overcome various kinds of malnutrition or malnutrition problems in toddlers, pregnant women and breastfeeding mothers. This study aims is to examines the effect of consuming *Moringa* leaf-based vegetable soup on milk production in breastfeeding mothers with stunted toddlers at Leggung Health Centre. A quasi-experimental design was employed with 40 breastfeeding mothers of stunted toddlers (0-2 years) - 20 in the treatment group (given Moringa soup) and 20 in the control group (no treatment). Pretest results showed that only 57% of mother in the treatment group had adequate milk production, which increased to 76% after consuming Moringa leaf vegetable soup. The Mann-Witney U test revealed a significant difference (p = 0.000). These findings suggest that Moringa leaf soup can enhance breast milk production in breastfeeding mothers and may indirectly support stunting prevention efforts. *(Afr J Reprod Health 2024; 28[10s]: 34-40).*

**Keywords:** *Moringa oleifera*, breast milk, stunting, mothers, toddlers

## Résumé

Le retard de croissance chez les tout-petits (0-2 ans) reste un problème de santé publique important en Indonésie. L'allaitement maternel adéquat est essentiel pour la prévention du retard de croissance, mais de nombreuses mères luttent contre une production de lait insuffisante. Le *Moringa oleifera*, connu localement sous le nom de Moringa, est traditionnellement utilisé pour augmenter la production de lait maternel. Les plantes de Moringa ont le potentiel de surmonter divers types de malnutrition ou de problèmes de malnutrition chez les tout-petits, les femmes enceintes et les mères qui allaitent. Cette étude vise à examiner l'effet de la consommation de soupe de légumes à base de feuilles de Moringa sur la production de lait chez les mères allaitantes ayant des tout-petits rabougris au centre de santé de Leggung. Un modèle quasi expérimental a été utilisé avec 40 mères allaitantes d'enfants en bas âge rabougris (0-2 ans) - 20 dans le groupe de traitement (ayant reçu de la soupe de Moringa) et 20 dans le groupe témoin (aucun traitement). Les résultats du pré-test ont montré que seulement 57 % des mères du groupe de traitement avaient une production de lait adéquate, qui est passée à 76 % après avoir consommé de la soupe de légumes à base de feuilles de Moringa. Le test U de Mann-Witney a révélé une différence significative (p = 0,000). Ces résultats suggèrent que la soupe aux feuilles de Moringa peut améliorer la production de lait maternel chez les mères qui allaitent et peut indirectement soutenir les efforts de prévention du retard de croissance. *(Afr J Reprod Health 2024; 28 [10s]: 34-40).*

**Mots-clés:** *Moringa oleifera*, lait maternel, retard de croissance, mères, tout-petits

## Introduction

Breastfeeding mothers have varied experiences when starting to breastfeed. Some babies will quickly latch and suckle, while others take longer and may need assistance[1]. Due to the challenges of breastfeeding, some mothers may become reluctant to breastfeed their toddlers (0-2 years). This reduces the opportunity for toddlers to receive adequate breast milk, despite the many essential nutrients that are beneficial to them and are found in breast milk[2]. Breast milk contains all the nutrients a baby needs during the first six months of life. Unless a mother is severely malnutrition, breast milk

typically meets the baby's nutritional needs[3]. *Moringa oleifera*, a plant that thrives in Indonesia, including Sumenep Regency, has been traditionally used by local communities as a vegetable and dietary supplement[4]. In an initial survey conducted by researchers on November 5, 2020, it was found that *moringa* plants are abundant in many areas of Sumenep Regency, where they have long grown in home gardens. Moringa leaves are used by the local people as vegetables and as a food complement in many family meals[5].

Previous studies show that *Moringa oleifera* contains a lot of nutrients beneficial to human health[6,7]. Moringa is particularly rich in iron, which plays an important role in haemoglobin production. Consuming *Moringa oleifera* can be an easy and accessible way to increase iron intake, reducing the need for iron supplements purchased at pharmacies[8]. This makes it a potential solution for breastfeeding mothers. Given its rich nutritional content, Moringa has great potential to address malnutritional in pregnant and breastfeeding women[9]. Research on moringa leaf powder revealed its high mineral content, including iron (177.74 ppm), calcium (16,350.58 ppm), sodium (1,206.54 ppm) and phosphorus (290.65 mg/100g), all of which are vital for combating anemia[11].

Stunting remains a significant public health challenge in Indonesia, especially in rural areas[1]. Stunting, characterized by growth disorders due to chronic malnutrition, affects not only children's physical development but also their cognitive abilities and future productivity[2]. Data in Indonesia indicate that in 2019, only 67.74% of toddlers received exclusive breast milk, surpassing the national target of 50%[10]. Addressing stunting in Indonesia requires early intervention. One approach is to increase breast milk production in breastfeeding mothers with stunted toddlers (0-2 years old)[5]. In Leggung Village, Batang-Batang District, Sumenep, the prevalence of stunting is notably high, reflecting an urgent need for effective and sustainable interventions. This study aims to evaluate the potential of *Moringa oleifera* in increasing breast milk production in breastfeeding mothers and analyze how positively affect the growth of stunted toddlers. These findings may help inform more targeted and effective public health policies for addressing stunting in Indonesia, aligning the Global Nutrition target of reducing the number of stunted children under five by 2025.

# Methods

### *Population*

The population in this study consisted of mothers breastfeeding toddler (0-2 Years) in the Legung Health Center work area from February to March 2021, totaling 60 individuals.

### *Sample*

Sampling was conducted using purposive sampling, a technique where samples are selected based on specific criteria, allowing the researcher to choose participants who best represent the population's characteristics[6]. From the total population of 60, a sample size of 40 was randomly selected through simple random sampling. Of the 40 respondents, 20 were assigned to the treatment group and 20 to the control group.

### *Study design and intervention*

This research was conducted in Leggung Village, Batang-Batang District, Sumenep, Indonesia, using a quasi-experimental research design. The treatment group received a daily intervention 200 cc of Moringa leaf soup for 20 days. The researcher and team provided the soup to the treatment respondents daily, to be consumed as part of their meal, typically at breakfast. The control group, who did not receive moringa soup, had their milk production monitored daily. The study aimed to assess the effect of Moringa leaf soup on breast milk production in the treatment group.

Before the intervention (pre-test), the volume of breast milk produced by both treatment and control groups was measured using manual breast pumps. The pre-test established basline characteristics of milk production. After the intervention, post-test measurements were taken only for the treatment group to assess changes in milk volume. The dependent variable was the amount of milk produced, while the independent variable was the consumption of moringa soup. Researchers and assistants visited the homes of treatment group participants to provide and monitor

the consumption of moringa soup, which could be consumed at any time of the day.

### *Inclusion and exclusion criteria*

The inclusion criteria for this study were as follows: mothers living in the Leggung Health Center work area, breastfeeding mothers stunted toddlers aged 0-2 years, and mothers willing to participate in the study, with informed consent obtained from all participants. The exclusion criteria included mothers who were ill (emergency cases), mothers with babies requiring special treatment, and mothers who withdrew from the study.

### *Statistical analysis*

The Kolmogorov-Smirnov test was first used to assess data distribution, determining whether the breast milk volume data were normally distributed. Based on these results, the two-sided Mann-Whitney U test was used for non-parametric continuous variables to evaluate differences between the treatment and control groups. A p-value of <0.05 was considered statistically significant.

### *Ethical considerations*

This study received ethical approval from the Faculty of Health Sciences, Wiraraja University Ethics Committee (approval No. 039/KEPK-FIK/UNIJA/V/2024).

## Results

The results in Table 1 show the volume of breast milk produced in the treatment and control groups of breastfeeding women. Table 1 shows that in the treatment group, 57% of mothers had medium breast milk production (50-80 ml) before consuming Moringa oleifera, but after the intervention, 76% of mothers produced a larger volume of 80-150 ml. This indicates a significant increase in breast milk production in the treatment group. In contrast, in the control group, most mothers had small milk production (0-50 ml) in the pre-test, with 12 mothers (63%). In the post-test, 12 mothers (63%) had medium milk production (50-80 ml), showing no significant increase in milk production for the control group.

**Table 1:** Distribution of frequency of pre-test and post-test of breastfeeding mothers in the treatment group and control group in the working area of the Leggung Health Center

| **Pumping results (cc)** | **Treatment group** | | | | **Control group** | | | |
|---|---|---|---|---|---|---|---|---|
| | **Pre-test** | | **Post-test** | | **Pre-test** | | **Post-test** | |
| | **F** | **%** | **F** | **%** | **F** | **%** | **F** | **%** |
| Large (80 – 150) | 0 | 0 | 15 | 76 | 0 | 0 | 0 | 0 |
| Medium (50 – 80) | 11 | 57 | 5 | 24 | 8 | 38 | 12 | 62 |
| Little (0 – 50) | 9 | 43 | 0 | 0 | 12 | 62 | 8 | 38 |
| Total | 20 | 100 | 20 | 100 | 20 | 100 | 20 | 100 |

**Table 2:** Kolmogorov-Smirnov test of normality of pre-test and post-test breast milk production in treatment and control groups

| **Group** | **Kolmogorov-Smirnov** | | | **Shapiro-Wilk** | | |
|---|---|---|---|---|---|---|
| | **Statistic** | **df** | **Sig.** | **Statistic** | **df** | **Sig.** |
| Pre-test | | | | | | |
| Control group | 0.398 | 20 | 0.000 | 0.671 | 20 | 0.000 |
| Experimental group | 0.184 | 20 | 0.073 | 0.917 | 20 | 0.085 |
| Post test | | | | | | |
| Control group | 0.261 | 20 | 0.001 | 0.887 | 20 | 0.024 |
| Experimental group | 0.231 | 20 | 0.006 | 0.924 | 20 | 0.119 |

**Table 3:** Mann-Whitney U test results of pre-test and post-test breast milk production in treatment and control groups

| Test statistics | Pre-test (treatment vs control) | Post-test (treatment vs control) |
|---|---|---|
| Mann-Whitney U | 81.000 | 8.000 |
| Wilcoxon W | 291.000 | 218.000 |
| Z | -3.410 | -5.269 |
| Asymp. Sig. (2-tailed) | 0.001 | 0.000 |
| Exact Sig. [2*(1-tailed Sig.)] | 0.001 | 0.000 |

**Table 4:** Mann-Whitney U test results for pre-test and post-test within treatment and control groups

| Test Statistics | Pre-test and post-test (treatment group) | Pre-test and post-test (control group) |
|---|---|---|
| Mann-Whitney U | 5.000 | 42.000 |
| Wilcoxon W | 215.000 | 252.000 |
| Z | -5.329 | -4.468 |
| Asymp. Sig. (2-tailed) | 0.000 | 0.000 |
| Exact Sig. [2*(1-tailed Sig.)] | 0.000 | 0.000 |

Table 2 shows that the pre-test normality values for the treatment and control groups abnormally distributed with a significance value > 0.05 (0.085). The post-test normality values were also abnormally distributed (0.119).

Table 3 reveals that the Mann-Whitney U test results for the pre-test and post-test breast milk production between the treatment and control groups show significant differences ($p < 0.05$), indicating that the hypothesis is accepted. This means that there is a significant difference between the treatment and control groups. Based on Table 4, it can be seen that the results of the pre-test and post-test for the treatment group, analyzed using the Mann-Whitney U test, show that the Asymp. Sig. (2-tailed) value is 0.000. This indicates that $0.000 < 0.05$, leading to the acceptance of the hypothesis. Similarly, the results of the pre-test and post-test for the control group show an Asymp. Sig. (2-tailed) value of is 0.000. This again indicates that $0.000 < 0.05$, allowing us to accept the hypothesis. Therefore, if the hypothesis is accepted, it suggests that there is a difference in the treatment group and the control group.

## Discussion

### *Breastfeeding and breast milk production in the control group*

In this study, the frequency distribution of pre-test and post-test breast milk production among breastfeeding mothers with stunted toddlers in the control group indicated that most mothers had low production criteria before the intervention. The post-test results revealed that mothers who did not consume *Moringa oleifera* vegetable soup had moderate production, indicating that their output remained insufficient. According to Agho *et al.*, one way to enhance both the quality and volume of breast milk is to increase the consumption of nutritious foods[7]. Maternal dietary intake is a significant factor influencing the composition and production of breast milk[7]. Furthermore, Utary *et al*. found that all respondents (100%) reported that their breast milk production was not smooth prior to consuming *Moringa oleifera* vegetable[8]. Researchers suggest that low breast milk production is often due to unbalanced nutrition, which can lead inadequate milk supply[21]. During breastfeeding, it is essential for mothers to consume a balanced and varied diet[9]. Increased nutritional intake correlates with higher breast milk production[10]. These findings align with research conducted by Mazumder, which identified variations in breast milk production among breastfeeding mothers, attributing these differences to factors such as nutrition, stress, and breastfeeding frequency. This underscores the need for interventions and nutritional support for breastfeeding mothers, especially during the early weeks postpartum[11].

### *Breastfeeding and breast milk production in the treatment group*

In the treatment group, breastfeeding mothers exhibited moderate breast milk production before the introduction of *Moringa oleifera* vegetables. After 20 days of consuming these vegetables, most mothers showed significant improvement in milk

production, achieving higher criteria that enabled them to provide sufficient breast milk to their stunted toddlers. Delfina *et al*. noted that *Moringa oleifera* contains phytosterols that can increase breast milk production, specifically citing its iron content (5.49 mg/100 g) and phytosterols, including sitosterol (1.15 %/100 g) and stigmasterol 1.52 %/100 g[20]. According to research by Sari and Marlian (2018), almost all respondents (85.7%) reported improved breast milk production after consuming *Moringa oleifera* vegetables, with only portion (14.3%) remaining unsatisfied with their milk supply[12].

### *Effect of moringa oleifera vegetable feeding on breast milk production in the working area of the Legung health center*

This study revealed significant difference between the treatment and control groups, indicating that feeding *Moringa oleifera* vegetables positively affects breast milk production in breastfeeding mothers with stunted children. The results of the Mann Whtitney U test support this conclusion, highlighting the importance of incorporating *Moringa oleifera* into the diets of breastfeeding mothers. In the study location, while most mothers provided exclusive breastfeeding for the first six months, some mothers-particularly those with stunted toddlers-struggled to do so, often citing inadequate breast milk supply as a reason for switching to formula. This underscores the importance of breastfeeding mothers carefully formulating their diets. In addition to maintaining a balanced diet, it is vital for them to choose food ingredients that can help increase breast milk production[13,14]. *Moringa oleifera* has attracted the attention of the health community due to its potential to increase breast milk production. Recent research indicates that *Moringa oleifera* is rich in essential nutrients, such as vitamins A, C, and E, as well as minerals like iron and calcium, that can stimulate breast milk production[13,22]. Supplementing with *Moringa oleifera* has been shown to enhance both the volume and quality of breast milk.[14]. Research conducted by Marsiami and Puspariny (2024) found that mothers who regularly consumed Moringa extract experience a 50% increase in breast milk production compared to the control group, with improvement not only in volume but also in nutritional quality of milk[15]. Further supporting evidence come from Mazumder *et al*., who reported that the consumption of biscuits and *moringa leaf extract* significantly increased breast milk volume in postpartum mothers[11]. This suggests that Moringa can be integrated into daily diets, thereby improving accessibility and acceptance among breastfeeding mothers. Cliffer *et al*. also demonstrated that regular consumption of Moringa leaves significantly increases breast milk volume and improves its nutritional content, essential for optimal infant growth and development[16].

Implementing a *Moringa oleifera* distribution program in Leggung village requires a comprehensive and community-based approach. Sukmawati *et al*. emphasized the importance of education and community empowerment regarding the use of local plants for health. This program should not only distribute supplements but also provide training on the proper processing and consumption of Moringa to maximize its benefits[5]. Safety is also a critical concern, although generally considered safe. Sinha *et al*. emphasized the need for further research into optimal dosage and potential long-term effects, particularly during breastfeeding[17]. The sustainability of this program is also a major concern. Januarti *at al*. proposed a community-based nutrition garden model focusing on cultivation and utilization of *Moringa oleifera*, which not only ensures a sustainable supply but also empowers the community economically through potential product development[18]. Long-term evaluations of the Moringa feeding program are urgently needed to validate its effectiveness in reducing stunting rates in Leggung village. Kusuma *at al*. recommended employing a mixed-method approach that combines quantitative analysis of child growth with qualitative interviews with mothers and health workers to comprehensively assess the program's impact[19].

This study has some limitations, such as a small sample size and a relatively short intervention period. A larger sample size and a longer intervention period could yield more strong results. Nevertheless, this study serves as a groundwork for further research on the effectiveness of *Moringa oleifera* in supporting breastfeeding mothers with stunted toddlers in remote areas.

## Conclusion

This study demonstrated that Moringa oleifera consumption significantly increased breast milk production in breastfeeding mothers of toddlers. Before the intervention, a majority of mothers in the treatment group had moderate breast milk production, while most mothers in the control group had lower levels of production. After consuming Moringa for twenty days, a substantial improvement was in the treatment group, whereas the control group showed only slight increase. Statistical analysis confirmed a significant difference between the groups. These findings highlight *Moringa oleifera* as a promising natural supplement to boost breast milk production. Future studies with larger sample sizes and longer intervention periods are recommended to further validate its efficacy and explore its potential as a sustainable solution for supporting breastfeeding mothers, particularly in areas with high stunting prevalence.

## Conflict of interest

The authors declare there is no conflict of interest.

## Contribution of authors

Zakiyah Yasin (ZY): Conceptualized and designed the study
Ahmad Nawawi (AN): Collected and analysed the data
Arief Wibowo (AW): Reviewed empirical studies and wrote the introduction
Siti Rahayu Nadhiroh (SRN): Designed the methodology
Shrimarti Rukmini Devy (SRD): Edited the paper

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