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Analysis of Differences in Breast Milk Production and Nutritional Status of Breastfeeding Mothers in Limo Subdistrict, Depok Before and After Consuming Food Bars Made from Katuk (*Sauropus Androgynus*) and Torbangun (*Coleus Amboinicus*) Leaves

Analisis Perbedaan Hasil Produksi ASI dan Status Gizi Ibu Menyusui sebelum dan setelah Konsumsi Food Bar Tepung Daun Katuk (Sauropus Androgynus) dan Daun Torbangun (Coleus Amboinicus) di Kelurahan Limo, Depok

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ABSTRACT

Background: Some mothers perceive that their breast milk production is insufficient, which hinders them from breastfeeding their infants. Based on data from the Indonesian Ministry of Health in 2022, only 52.2% of infants in Indonesia receive exclusive breastfeeding, below the target of 80%. Previous research shows that the consumption of food bars made from a combination of torbangun and katuk leaf flour can increase breast milk production, compared to consuming the leaves separately. Additionally, maternal nutritional status also plays a role. Mothers with good nutritional status tend to produce breast milk of better quantity and quality.
Objectives: This study aimed to evaluate and compare the effectiveness of food bars made from katuk and torbangun leaf flour in increasing breast milk production and the nutritional status of breastfeeding mothers in Limo Subdistrict, Depok.
Methods: This study employed a quasi-experimental method with a pre- and post-test without control group design. This study was conducted for four days. Data were analyzed using the Shapiro-Wilk test for normality, followed by appropriate statistical tests (paired t-test if normally distributed or Wilcoxon test if non-normally distributed). The sample consisted of 15 participants selected through simple random sampling.
Results: The paired t-test results showed a p-value of <0.001, indicating a significant difference in breast milk production before and after the consumption of food bars made from katuk and torbangun leaf flour. However, the analysis of maternal nutritional status yielded a p-value of 0.317 (>0.05), indicating no significant difference in maternal nutritional status before and after the consumption of the food bars.
Conclusions: The findings indicate that consuming food bars made from katuk and torbangun leaf flour effectively increases breast milk production. However, their consumption does not significantly affect the nutritional status of breastfeeding mothers.

INTRODUCTION

Breastfeeding or lactation is a physiological process that involves the production, expression, and provision of breast milk to newborns. This process is regulated by complex interactions between hormonal, neurological, and psychological factors[1]. Breast milk serves as the optimal source of nutrition for infants during the early stages of life. In addition to providing essential nutrients, breast milk contains antibodies, especially colostrum, which is rich in immunoglobulin A (IgA). This component protects infants from infections by forming a protective layer in the respiratory and digestive tracts. Exclusive breastfeeding for the first six months of life can reduce the risk of illnesses, promote healthy weight gain, and support optimal brain development[2].

The Indonesian Ministry of Health has set a target to increase the coverage of exclusive breastfeeding of 80% nationally. However, the achievement remains low[3]. Data from the National Institute of Health Research and Development in 2019 reported that the coverage of exclusive breastfeeding among infants was 74.5%, while the 2021 survey by the Ministry of Health recorded a figure of 69.7%[4]. Moreover, the Indonesian Nutritional Status Survey in 2022 revealed that only 52.2% of infants aged 0-5 months were exclusively breastfed[5]. One of the provinces that

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has not achieved this target is West Java. While the coverage of exclusive breastfeeding in this province increased from 76.46% in 2021 to 77% in 2022, the figure remains below the national target of 80%[6].

Several factors hinder exclusive breastfeeding in West Java, including the perception of insufficient milk production, a lack of knowledge and support for lactation, challenges in practicing early initiation of breastfeeding, and various health, socio-demographic, socio-cultural, and environmental influences[7,8]. One of the most common obstacles is the mother's perception of insufficient breast milk production to meet the baby's nutritional needs. A qualitative study by Bakara and Fikawati on mothers of children aged 0-6 years conducted at the Cipayung Community Health Center in Depok, Indonesia revealed that 68.1% of respondents did not adhere to the exclusive breastfeeding schedule, with perceptions of insufficient breast milk being a significant contributing factor[8]. Psychological and environmental factors play a significant role in influencing breastfeeding practices. The mother's emotional condition can affect breast milk production through hormonal regulatory mechanisms. Adequate social support and a conducive environment can foster maternal well-being. Conversely, physical and mental fatigue can pose barriers to optimal breast milk production.

Furthermore, the mother's nutritional status plays an important role in meeting the baby's nutritional needs. Mothers with good nutritional status tend to produce breast milk of optimal quantity and quality compared to those with poor nutritional status[9]. Therefore, mothers need to maintain a balanced diet and ensure adequate nutritional intake to support breast milk production. The nutritional needs of breastfeeding mothers are related not only to the number of additional calories, but also to the type of nutrients consumed. In other words, maternal health during breastfeeding requires attention to physical, emotional, and nutritional aspects to ensure the well-being of both mother and baby.

A study found that 30%-70% of mothers chose to stop exclusive breastfeeding in the first week after giving birth due to the perception of insufficient breast milk production.[10,11] Another study showed that 56.7% of breastfeeding mothers shared the same perception, believing that they were unable to produce enough breast milk.[12] Breast milk production can be increased by consuming vegetables such as katuk (*Sauropus androgynus*) and torbangun *(Coleus amboinicus*) leaves, which are known to have benefits for supporting increased breast milk production. Katuk leaves and torbangun leaves contain various bioactive compounds that have galactogenic properties[12]. Katuk leaves contain alkaloids, sterols, triterpenoids, tannins and flavonoids, while torbangun leaves contain phenolic compounds, tannins, flavonoids, anthocyanins and phytosterols[13].

The prolactin hormone, produced by the anterior pituitary gland, plays a central role in stimulating breast milk production. Increased prolactin levels stimulate the proliferation and differentiation of alveolar cells in the mammary glands, thereby increasing the capacity for milk production and secretion. The oxytocin hormone also plays an important role in breastfeeding. Oxytocin stimulates the contraction of myoepithelial cells around the alveoli, facilitating the flow of breast milk into the milk ducts and toward the nipples. Oxytocin stimulation usually occurs when the baby is breastfeeding, with a positive feedback mechanism that increases milk production and release[14].

Nevertheless, the consumption of katuk leaves and torbangun leaves remains suboptimal. For example, in Bantul, Yogyakarta, only 86.5% of women process katuk leaves as vegetables[15]. Another study showed that pregnant women generally dislike vegetables[16]. In West Java, the local potential of katuk and torbangun plants is relatively high because these plants are widely found and have long been used in traditional medicine and for community consumption. These two plants have benefits as galactagogues, which help increase breast milk production by stimulating the prolactin and oxytocin hormones. However, their use in West Java and other regions in Indonesia is not fully optimal. Research shows that although these plants are widely recognized as breast milk-stimulating vegetables, their consumption remains limited. Processing katuk leaves remains uncommon in certain areas, and many breastfeeding mothers do not routinely consume them as part of their diets. This low consumption can be attributed to food preferences and low levels of vegetable consumption. To overcoming this challenge, previous research introduced an innovative solution by combining katuk and torbangun leaf flour to make food bars[17]. Food bars are solid, high-calorie food products made from a combination of various food ingredients and formed into compact products using binders such as syrup, nougat, caramel, and chocolate. Food bars are often used as emergency foods because they have a long shelf life[17].

Food bars have small sizes, making them easier to pack, distribute, and store. To develop food bars as supplementary feeding for breastfeeding mothers, appropriate formulations are needed. Previous studies have been tested food bars for their proximate composition, physical and organoleptic properties, nutritional content, and effectiveness. However, the research on their effectiveness has been limited a small-scale testing, involving only 10 breastfeeding mothers carried out for three days, necessitating further investigation.

Based on the aforementioned background, one of the factors contributing to the low rate of exclusive breastfeeding the perception among mothers that their breast milk production is insufficient to meet their baby's nutritional needs. This presents a challenge for breastfeeding mothers in maintaining adequate breast milk production. Based on previous research which has developed katuk and torbangun leaf flour into food bars, this study aims to analyze and explore further the differences in breast milk production and nutritional status of breastfeeding mothers following the consumption of food bars made from katuk and torbangun leaf flour. This study seeks to provide a deeper understanding of the potential of this innovative solution to enhance breast milk production, improve the nutritional status of breastfeeding mothers, and increase the quality of the breast milk for infants.

METHODS

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This study was conducted for four months, from January 2024 to April 2024 at various locations. The preparation of torbangun and katuk leaf flour was carried out at the SEAFAST Center, IPB University Dramaga Campus, Bogor, West Java. The production of food bars was carried out at the Nutrition Science building, UPN "Veteran" Jakarta. Finally, the intervention stage was conducted in Limo Subdistrict, Depok.

This study employed a quantitative approach with a quasi-experimental method with a pre- and post-test without control design. The intervention involved a single group without a control group, and the effectiveness of the treatment was assessed by comparing the results of pre- and post-test. The study population consisted of all breastfeeding mothers in Limo Subdistrict, Depok. The sample included breastfeeding mothers in the subdistrict selected through a simple random sampling technique. To anticipate for potential dropouts, the calculated sample size for this study was increased by 10%, resulting in a total of 15 participants. This study received ethical approval from the Ethics Committee of Health Research, UPN "Veteran" Jakarta under a certificate number 360/IX/2023/KEPK on September 7, 2023.

Intervention

Participants were provided with a food bar containing 2.5% torbangun flour (7 grams), 5% katuk flour (14 grams), and 46.5% wheat flour (Segitiga Biru, 130.2 grams). Additional ingredients included 1% salt (Refina, 2.8 grams), 13% sugar (Gulaku, 36.4 grams), 15% full cream milk powder (Frisian Flag, 42 grams), 5% margarine (Blue Band, 14 grams), and 12% eggs (33.6 grams). The total composition reached 100%, with a final food bar weight of 280 grams[17]. The detailed process of producing the food bars made from katuk and torbangun leaf flour is as follows.

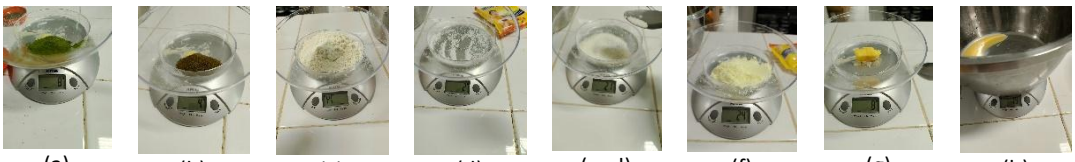
Tools

(a) (b) (c) (d)
(and) (f) (g) (h)

(a) Punching machine, (b) 30 x 30 mold, (c) stainless basin, (d) plate, (e) scale, (f) mixer, (g) oven, (h) packaging

Figure 1. Tools for producing food bars made from katuk and torbangun leaf flour

Materials



(a) (b) (c) (d) (and) (f) (g) (h)

(a) Torbangun leaf flour, (b) katuk leaf flour, (c) wheat flour (Segitiga Biru), (d) salt (Refina), (e) sugar (Gulaku), (f) full cream milk powder (Frisian Flag), (g) margarine (Blue Band), and (h) eggs

Figure 2. Ingredients for producing food bars made from katuk and torbangun leaf flour

Procedures for Making Katuk and Torbangun Leaf Flour

(a) (b) (c) (d)

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(and) (f) (g) (h)

(a) Sort katuk and torbangun leaves into separate basins, (b) (c) wash them with running water, (d) (e) dry them using a steam machine, (f) grind them using a pounding machine, (h) the resulted katuk and torbangun leaf flour

Figure 3. Product development flow of katuk and torbangun leaf flour

Product Development Flow of Food Bars Made from Katuk and Torbangun Leaf Flour

(a) (b) (c) (d) (and) (f)

(a) Prepare the ingredients, (b) add sugar and eggs into a container, mix them using a mixer, and add margarine, (c) add flour, milk powder, and salt little by little, (d) add katuk and torbangun leaf flour and mix again, (e) mold the dough in a cake mold measuring 30 x 30 cm and place it in the oven at 130°C for 15 minutes, (f) the resulted product (food bars)

Figure 4. Product creation flow of food bars made from katuk and torbangun leaf flour

Measurement of Breast Milk Production and Anthropometry of Maternal Nutritional Status

Breast milk production was measured using the method developed by Dewey and Lonnerdal[20] which relies on the measurement of the baby's weight. The procedure involved weighing the baby before and after breastfeeding using a baby scale (Balmed) with an accuracy of 5 grams. Breast milk production was calculated based on the difference in the baby's weight before and after breastfeeding, then summed to obtain the total weight difference over a 24-hour period. To account for breast milk density, the difference in body weight was multiplied by a conversion factor of 0.983 ml/g, yielding the total volume of breast milk produced by the mother in one day[20].

The nutritional status of the participants was evaluated using the Body Mass Index (BMI). Data on the respondents' weight and height were obtained through direct measurements during the study using a microtoise for height with an accuracy of 0.1 cm and a digital scale for body weight with an accuracy of 0.1 kg. These measurements were carried out directly by the researchers.

Research Procedures

The intervention began with obtaining informed consent, followed by the completion of questionnaires and observation sheets through direct interviews by the researchers. The breast milk volume observation sheet was adopted from previous research[19]. First, the mother's weight and height were measured, then the breast milk volume was observed and measured. Subsequently, the participants were provided with the intervention in the form of eight food bars (280 grams) per day, according to the portion determined based on previous research[17]. The intervention was carried out for four consecutive days. According to Coward, measuring breast milk volume using body weight should be conducted for at least 3-4 days to minimize the effects of daily variations in breast milk intake[21]. Following the intervention, the participants again completed the breast milk volume observation sheet to evaluate the changes that occurred. Additionally, their nutritional status was measured based on their BMI, taking into account both maternal weight and height. Data processing and analysis were performed using Microsoft Office Excel 2010 and the Statistical Package for the Social Sciences (SPSS) version 25, including univariate and bivariate analyses. Univariate analysis was used to determine the frequency distribution, while bivariate analysis was used to determine the differences before and after the intervention. The data were tested for normality using the Shapiro-Wilk test, followed by statistical tests in accordance with the data distribution (paired t-test if normally distributed and Wilcoxon test if non-normally distributed).

RESULTS AND DISCUSSIONS

Univariate Analysis

The respondents in this study consisted of 15 individuals who lived in Limo Subdistrict, Depok City. The inclusion criteria for this study were breastfeeding mothers with babies aged 0-6 months who were willing to participate in this study until its completion. This intervention study involved one-group pre- and post-test design with assessments carried out before and after treatment.

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Table 1. Characteristics of breastfeeding mothers

Characteristics	Frequency (n = 15)	%
Age of the Breastfeeding Mother		
Late adolescence (20-25 years)	3	20
Early adulthood (26-35 years)	9	60
Late adulthood (36-49 years)	3	20
Total	15	100
Sex of the Baby		
Male	4	26.7
Female	11	73.3
Total	15	100
Parity		
Primiparous	4	26.7
Multiparous	11	73.3
Total	15	100
Education Level		
Elementary school	2	13.3
Junior high school	2	13.3
Senior high school	5	33.3
Diploma I, II, and III	4	26.7
Diploma IV/Undergraduate	2	13.3
Total	15	100
Employment Status		
Employed	13	86.7
Unemployed	2	13.3
Total	15	100

Diploma I: One-year vocational education program
Diploma II: Two-year vocational education program
Diploma III: Three-year vocational education program
Diploma IV: Four-year vocational education program, equivalent to a Bachelor's degree
Undergraduate: Bachelor's degree

Table 1 shows the characteristics of the breastfeeding mothers. The demographic data on maternal age indicate that three respondents (20%) were 20-25 years old, nine (60%) were 26-35 years old, and three (20%) were 36-49 years old. According to Purborini and Rumaropen, the productive age for pregnancy is considered to be 20-35 years as the reproductive organs of prospective mothers have fully developed[22].

According to the National Population and Family Planning Agency, the age range of 20-35 years is considered the ideal productive age for women to give birth, which is consistent with a study by Riyanti et al., which revealed that the quality of women's egg cells during fertilization is healthier at the ages of 20 -35 years compared to before the age of 20 years or after the age of 35 years[23].

The following data are on parity. Parity is an important aspect to consider because it is related to a woman's experience, physiological changes, and hormonal variations[24]. Table 2 presents the parity data of the breastfeeding mothers. The majority of breastfeeding mothers had experienced more than one pregnancy, with 11 respondents (73.3%) being multiparous.

Leiwakabessy and Azriani observed a relationship between breast milk production and parity with a p-value of 0.053. This finding suggested that parity influences the initiation of lactation, with multiparous mothers generally experiencing a smoother initiation of breastfeeding than primiparous mothers[25]. The successful initiation of lactation is a determining factor in the success of breastfeeding in subsequent stages. Differences in psychological readiness between primiparous and multiparous mother also play a role. Primiparous mothers tend to feel more anxious and unstable psychological conditions, which can affect the release of hormones that play a role in breast milk production[26].

In terms of education, five respondents (33.3%) had completed senior high school, two respondents (13.3%) had completed elementary school, and two

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respondents (13.3%) had completed junior high school. Additionally, four respondents (26.7%) had completed education at diploma I, II, or III level, while two respondents (13.3%) had completed education at diploma IV or undergraduate level. In other words, the education level of the respondents was relatively high. Education has a significant relationship with individual thought patterns, perceptions, and behaviors. A higher level of education is associated with more rational decision making. This is consistent with a study by Fadlliyyah which showed that mothers with higher education levels tended to exhibit better behaviors in providing exclusive breastfeeding. This is because in individuals with higher education are expected to think rationally about what is best for their children[27].

Employment status was categorized into employed and unemployed, which can influence breastfeeding practices due to differences in the time mothers spend with their babies. Among the respondents, 13 mothers (86.7%) were employed, while two mothers (13.3%) were unemployed. A study by Ramli suggested that working is not a valid excuse for not providing breast milk to children. High levels of knowledge about the importance of breast milk, understanding how to express breast milk, and the availability of supporting tools can motivate mothers to continue providing exclusive breast milk despite their employment status[28].

Table 2. Characteristics of infants

Characteristics	Frequency (n = 15)	%
Age of the Infant (Months)		
1	2	13.3
2	1	6.7
3	3	20.0
4	4	26.7
5	5	33.3
Total	15	100
Gender of the Infant		
Male	4	26.7
Female	11	73.3
Total	15	100

Table 2 presents data on the characteristics of the respondents' infants. In this study, two infants (13.3%) were one month old, one infant (6.7%) was two months old, three infants (20.0%) were three months old, four infants (26.7%) were four months old, and five infants (33.3%) were five months old. In terms of sex, four infants (26.7%) were male, while 11 infants (73.3%) were female. In other words, the majority of the infants of breastfeeding mothers in this study were female, which can be attributed to limitations in the data collection process and access to respondents.

Bivariate Analysis

Breast Milk Production Before and After Consuming Food Bars Among Breastfeeding Mothers

Breast milk production is influenced by various interacting factors, such as the frequency of breastfeeding, maternal health, nutritional status, and stress levels, as well as the condition of the baby. In this study, the respondents were instructed to consume food bars according to the prescribed portion, namely 280 grams per day, divided into eight pieces (35 grams). The consumption of the food bars was spread across the day, with two pieces in the morning, two in the afternoon, two in the afternoon, and two in the evening. This consumption pattern was maintained for four consecutive days.

Table 3 Breast milk production (ml/day) before and after intervention

Condition	Total breast milk production (ml/day)		p-value
	Mean	SD	
Before treatment	69.99	4.61	<0.001*
After treatment	133.49	11.50	

(*) Paired t-test results, significant p-value <0.001; SD (Standard Deviation)

The increase in breast milk production was observed through the increase in breast milk volume based on the baby's weight measured on the first and last days of the intervention. Breast milk volume was measured in milliliters (ml). The average breast milk production on the first day was 69.99 ml, while the average breast milk production on the last day was 133.49 ml. The average percentage increase in breast

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milk production was 90.70%. Overall, the results indicated a significant increase for each respondent. However, variations in increased breast milk production among individuals may be influenced by other factors such as health conditions, diet, and lifestyle[29].

These findings are consistent with a study conducted by Handayani *et al.* on the effect of consuming katuk leaf biscuits on breast milk volume production. Their study demonstrated a significant increase in breast milk volume after consuming katuk leaf biscuits, with an increase of 79.6% on the tenth day. Moreover, the paired t-test in this study yielded a p-value of 0.000 (p-value<0.05), indicating that the consumption of food bars containing torbangun and katuk leaves had an effect on increasing breast milk production in breastfeeding mothers[30].

Lutfiani and Nasrulloh suggested that food bars made from torbangun and katuk flour can be used as emergency food[17]. Their findings demonstrated that the addition of torbangun and katuk flour significantly increased breast milk volume, with a p-value of 0.002. The study observed an increase of 54.98% in the average breast milk volume after consuming the food bars.

The effectiveness of katuk and torbangun leaves is attributed to their bioactive galactagogue compounds, which stimulate the prolactin and oxytocin hormones. Katuk leaves contain phytochemical compounds such as alkaloids, sterols, triterpenoids, tannins, and flavonoids, while torbangun leaves contain bioactive compounds such as phenolics, tannins, flavonoids, anthocyanins, and phytosterols[13]. According to Damanik *et al.*, torbangun leaves contain digiprolactone and kaempferol derivatives (flavonoids from the flavonols), while katuk leaves contain isoflavones and quercetin as phytoestrogens. These compounds contain active components that can influence breast milk production[32].

Izzaty, Astuti, and Cholimah argued that phytoestrogens can increase gene expression and prolactin (PRL) secretion directly via estrogen receptors (E2R) and indirectly through membrane estrogen receptors (mE2R) by inhibiting dopamine receptors (D2R). In the mammary glands, this process ultimately increases milk production[33].

According to Lutfiani and Nasrulloh, the nutritional composition of one serving of the food bar (280 g) includes 866.63 kcal of energy, 22.91 g of total fat, 33.08 g of protein, 132 g of carbohydrates, 33 g, and 100.8 mg of flavonoids. When compared to the Nutritional Adequacy Rate for breastfeeding mothers who require 2615 kcal, one serving of the food bar can meet 33% energy, 8% total fat, 5% protein and 20% carbohydrates. Furthermore, food bars made from katuk and torbangun leaf can effectively increase breast milk production if consumed consistently at a minimum dose of 160 grams per day. This portion provides 564 kcal of energy, 90.2 grams of carbohydrates, 19.5 grams of fat, and 17.6 grams of protein[19].

Changes in the Nutritional Status of Breastfeeding Mothers Following the Consumption of Food Bars

Figure 5. Food bars made from katuk *(Sauropus Androgynus)* and torbangun *(Coleus Amboinicus)* leaves

The nutritional status of breastfeeding mothers was assessed based on their BMI. Prior to classification, BMI was calculated and categorized based on the 2014 normal nutritional assessment guidelines. According to these guidelines, a BMI of less than 18.5 is classified as underweight, 18.5-25.0 as normal, 25.1-27.0 as overweight, and more than 27.0 as obese[34]. The following table presents data on the frequency distribution of the nutritional status of breastfeeding mothers on the first and fourth days before and after the consumption of food bars.

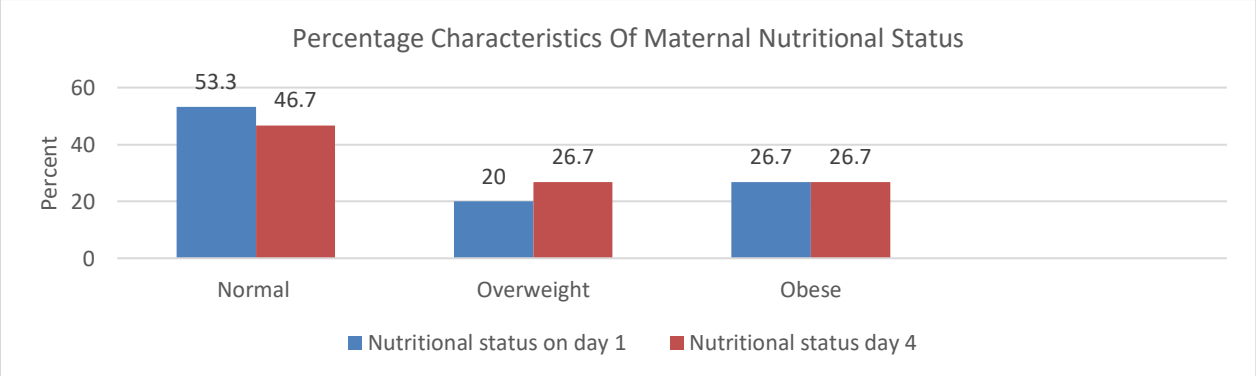

Figure 6. Maternal nutritional status

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Figure 6 shows the nutritional status of the respondents on the first and fourth days. On the first day, eight respondents (53.3%) had normal nutritional status, three respondents (20.0%) were classified as overweight, and four respondents (26.7%) were classified as obese. In other words, the majority of respondents (53.3%) fell within the normal nutritional status. On the fourth day, seven respondents (46.7%) had normal nutritional status, four respondents (26.7%) were categorized as overweight, and four respondents (26.7%) were categorized as obese. This change in distribution provides an overview of the dynamics of the nutritional status of the respondents during the four days of intervention. The slight change from normal to overweight categories in a short period may be influenced by various factors, including inconsistencies in the field despite careful execution of this study. This highlights a limitation of this study and underscores the need for longer intervention periods in future research.

Many factors can cause an increase in nutritional status. Amelia stated that the influencing factor for nutritional status is food intake, as the body requires sufficient energy, protein, and fat during the growth period. Achieving normal nutritional status reflects a balance between nutritional needs and nutritional fulfillment[35]. Mothers with good nutritional status are generally better equipped to produce breast milk optimally, ensuring smooth lactation. Smooth breastfeeding is crucial for meeting the baby's nutritional needs, thereby supporting their baby's health and development.

Table 4. Maternal nutritional status after the consumption of food bars

Measurement	Total breast milk production (ml/day)		p-value
	Mean	SD	
Nutritional status on day 1	2.73	0.88	0.317*
Nutritional status on day 4	2.80	0.74	

(*) Wilcoxon test results, not significant p-value (0.317>0.05); SD (Standard Deviation)

Based on Table 4, the results of the statistical analysis showed that the average nutritional status on the first day was 2.73 ± 0.88, while on the fourth day was 2.80 ± 0.74. The small change observed from 2.73 to 2.80 is most likely a result of normal variation in the measurements and does not indicate a significant change in nutritional status. Furthermore, the analysis yielded a p-value of 0.317 (p-value> 0.05), indicating no significant difference in the nutritional status of breastfeeding mothers before and after consuming the food bars. This suggested that the consumption of food bars made from torbangun and katuk leaves have no impact on the nutritional status of breastfeeding mothers. Nutritional status is a reflection of nutritional adequacy, which is measured using the BMI. However, BMI alone is not enough to determine overall nutritional status as it does not differentiate between fat mass and non-fat mass[36]. For breastfeeding mothers, good nutritional status is essential to ensure optimal breast milk production, both in terms of quantity and quality[36].

According to a study by Sari and Dewi, maternal nutritional status plays a crucial role in fulfilling the nutritional needs of infants. Mothers with good nutritional status tend to produce higher quantity and quality of breast milk than mothers with poor nutritional status[9].

In this study, the use of local ingredients such as katuk leaves and torbangun in the form of food bars was considered a practical innovation and proven to be effective in significantly increasing breast milk production. This effectiveness is supported by the phytochemical content such as flavonoids, alkaloids, and phenolics which are galactagogues, as well as by a systematic research design and standardized breast milk volume measurement methods.

However, the results of the study showed that the intervention did not provide significant changes in the nutritional status of breastfeeding mothers. This could be caused by several factors. First, the duration of the intervention which only lasted for four days was considered too short to cause changes in nutritional status, which generally requires time and consistent intake in the long term. Second, the dose of food bars consumed may not have been high enough to affect overall nutritional status.

In addition, the nutritional status of mothers is greatly influenced by other factors such as diet, eating frequency, food consumption habits, health conditions, and metabolism of each individual. Differences in metabolism between breastfeeding mothers also play a role in determining how the body responds to intake from the food bar.

This study also has other limitations, including the use of baby scales that were not calibrated at all times, and the lack of direct supervision of the weighing process at night and early morning, which could potentially lead to data bias. Therefore, although food bars have been shown to be effective in increasing breast milk production, further research with a larger number of respondents, a longer intervention duration, and an approach that takes into account lifestyle and dietary factors as a whole is needed to evaluate the effect of food bars on the nutritional status of breastfeeding mothers more comprehensively.

CONCLUSIONS

This study was conducted on a group of breastfeeding mothers in Limo Subdistrict, Depok, where the majority of respondents were aged 26-35 years, had a senior high school education, and were employed. Most of the respondents were multiparous mothers with female infants. Consuming food bars made from katuk and torbangun leaf flour was found to be effective in increasing breast milk production among breastfeeding

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mothers. However, no significant differences were observed in maternal nutritional status before and after the intervention. To increase the effectiveness and acceptability of the product, it is recommended to reduce the daily serving size of the food bars and consider adding ingredients such as chocolate to mask the aroma and bitter taste.

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CONFLICT OF INTEREST AND FUNDING DISCLOSURE

This study was privately funded. The authors declare no conflict of interest regarding this study.

AUTHOR CONTRIBUTIONS

DK: conceptualization, investigation, methodology, data collection, and writing of the initial manuscript. DLS: supervisor, validation, editor, and management. NN: analysis, resource provider, supervisor, validation, proofreading, and administration.

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