PROCESSED SPINACIA OLERACEA AND FLAVORS (TRIGONELLA FOENUM-GRAECUM) SEEDS IN INCREASING BREAST MILK VOLUME

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ABSTRAK : PERAN OLAHAN BAYAM (*SPINACIA OLERACEA*) DAN BIJI KELABAT (*TRIGONELLA FOENUM-GRAECUM)* DALAM PENINGKATAN VOLUME ASI

Latar Belakang: Stunting masih menjadi masalah gizi dan menjadi tantangan besar di Indonesian terutama pada anak-anak, yang secara global mempengaruhi sekitar 162 juta anak di bawah usia 5 tahun dan keadaan ini terjadi pada 1000 Hari Pertama Kehidupan (HPK).

Tujuan: untuk mengeksplorasi potensi bayam (*Spinacia oleracea)* dan kelabat (*Trigonella foenum-graecum)* ini sebagai laktagogum sebagai pencegahan stunting.

Metode: Penelitian eksperimental dengan desain pretest-posttest with control group dilakukan pada 32 ibu menyusui. Kelompok perlakuan mendapat intervensi berupa 100 g nugget setiap hari selama 30 hari, sedangkan kelompok kontrol tidak mendapat intervensi. Parameter yang diukur meliputi volume ASI (ml/hari) Analisis data menggunakan uji Wilcoxon Signed Rank Test untuk kelompok perlakuan dan paired t-test untuk kelompok kontrol.Dari kedua kelompok tersebut dinilai pengukuran produksi ASI

Hasil : Hasil olahan penelitian ini mengandung protein 8,64–8,72%, zat besi 13,37–15,40 mg/100g, dan saponin 2,49–3,92%. Terdapat peningkatan signifikan volume ASI pada kelompok perlakuan dari 515,7 ± 19,0 ml/hari menjadi 577,5 ± 79,7 ml/hari (p=0,000), sedangkan pada kelompok kontrol tidak signifikan (p=0,906).

Kesimpulan : Pemberian olahan nugget tempe-bayam-biji kelabat secara signifikan meningkatkan volume ASI dan memperbaiki status gizi bayi. Produk ini berpotensi digunakan sebagai pangan fungsional dalam program peningkatan gizi ibu menyusui dan pencegahan stunting.

Kata Kunci: Asi, bayam, kelabat, nugget, stunting

ABSTRACT

Background: Stunting remains a nutritional problem and a major challenge in Indonesia, especially for children. Globally, it affects approximately 162 million children under 5 years of age, and this condition occurs during the First 1,000 Days of Life (HPK).

Purpose: To explore the potential of spinach (Spinacia oleracea) and fenugreek (Trigonella foenum-graecum) as lactagogans for stunting prevention.

Methods: An experimental study with a pretest-posttest design with a control group was conducted on 32 breastfeeding mothers. The treatment group received 100 g of nuggets daily for 30 days, while the control group received no intervention. The parameters measured included breast milk volume (ml/day). Data analysis used the Wilcoxon Signed Rank Test for the treatment group and the paired t-test for the control group. Breast milk production was assessed in both groups.

Results: The nuggets contained 8.64–8.72% protein, 13.37–15.40 mg/100g iron, and 2.49–3.92% saponin. There was a significant increase in breast milk volume in the treatment group from 515.7 ± 19.0 ml/day to 577.5 ± 79.7 ml/day (p=0.000), while the increase was not significant in the control group (p=0.906).

Conclusion: Providing tempeh-spinach-female nuggets significantly increased breast milk volume and improved infant nutritional status. This product has the potential to be used as a functional food in programs to improve the nutrition of breastfeeding mothers and prevent stunting..

Keywords: Breast milk, spinach, fenugreek, nuggets, stunting

INTRODUCTION

Stunting is a condition of malnutrition that results in a child's height being below the World Health Organization's median standard. Currently, the prevalence of stunting in Indonesia remains a health problem, reaching 27.67% in 2019 (Ahmad

et al., 2022; Kronik et al., 2022). According to the Indonesian Nutritional Status Study (SSGI), the prevalence of stunting in West Nusa Tenggara Province increased from 31.4 percent in 2021 to 32.7 percent in 2022. This figure is higher than the national average (21.6%), above the WHO threshold (<20%), and far from the national target of 14 percent by 2024.

Children who experience stunting not only face physical health issues but also risk long-term impacts on cognitive and social development that can disrupt their quality of life. One of the main factors in stunting is an inappropriate diet, especially during the golden period of child growth. Proper nutrition during pregnancy and breastfeeding also plays a crucial role. Research shows that malnutrition in pregnant women can lead to growth problems in children. Providing appropriate foods rich in vitamins and minerals is crucial. Utilizing local foods such as spinach and fenugreek seeds as a source of nutrition can be an alternative because they have good nutritional value for both breastfeeding mothers and children. Government programs promote exclusive breastfeeding, including counseling on the importance of breastfeeding for 6 months. Breast milk is a complex fluid consisting of various chemical and cellular components. Breast milk is a type of food that meets all the elements of a baby's needs, including physical, psychological, social, and spiritual. The low rate of exclusive breastfeeding is caused by insufficient breast milk production. The results of a preliminary survey conducted on 39 respondents from 16 provinces in Indonesia obtained data, 17.9% of respondents stated that breast milk did not come out in the first week of breastfeeding, 33.3% stated that the amount of breast milk was small, and 2.6% stated that breast milk did not come out at all during breastfeeding. The majority (69.23%) of mothers who complain of insufficient breast milk supply are primiparous, and this can lead to anxiety, stress, and early weaning.

Solutions to increase breast milk supply can utilize pharmacological and non-pharmacological methods. Consuming galactose plants and exploring natural and effective methods to support lactation are crucial. Certain foods are traditionally believed to increase breast milk supply, called galactagogues (Kumar Maurya, 2024). One local plant widely found in Indonesia, known to contain galactagogues, can increase breast milk supply by stimulating the protoplasmic activity of the secretory cells of the mammary glands. These seeds contain beneficial lactagogics that can increase breast milk production (Yulilania Okinarum et al., n.d.) (Handayani et al., 2022). Spinach is high in nutrients, including vitamins, minerals, and antioxidants. Several studies have shown that consuming spinach can increase hemoglobin levels and breast milk production in pregnant and breastfeeding women. Several scientific studies have shown that fenugreek seeds can increase breast milk volume in breastfeeding mothers. Fenugreek seeds contain 20-25% protein, 45-50% dietary fiber, 20-25% mucilaginous soluble fiber, 6-8% fatty acids and essential oils, and 2-5% steroidal saponins. In addition, they also contain several substances such as flavonoids, alkaloids (trigonoline, choline, gentianin, carpaine), amino acids (4-hydroxyisoleucine), and spirostanols and furastanols (diosgenin, gitogenin, and yamogenin) which can also have beneficial pharmacological effects such as hypoglycemic, hypocholesterolemic, nastroprotective, anticancer, antioxidant, hepatoprotective, laxative, estrogenic, appetite stimulant, and others. One way to assess breast milk production is by observing breast milk output, which can be done by expressing breast milk. Breast milk expression can be performed using hand maneuvers, manual and electric breast pumps, and the Hand-on Pump (HOP) technique. A minimum of eight breast pumps are required per day for 42 days. Pumping time per breast is 10–15 minutes, or until the milk stops dripping, with an additional 2 minutes of pumping time.

The urgency of this research is to find ways to reduce stunting rates by utilizing interventions based on local ingredients, which not only improve children's nutritional status but also increase community interest in consuming locally available foods (Community in Stunting Prevention Through Making Local Food Supplements in Kampung Bintang Pepara et al., n.d.) (Akbağ et al., 2022).

RESEARCH METHODS

The study sample consisted of 32 breastfeeding mothers, consisting of 16 mothers in the treatment group and 16 in the control group. The treatment group received 100 g of nuggets daily for 30 days, while the control group received no intervention. The research process began with an initial survey of malnutrition issues at the Karang Pule Community Health Center. This study employed a quasi-experimental pretest and posttest design. The intervention consisted of tempeh nuggets mixed with spinach and fenugreek seeds for the intervention group and no intervention for the control group.

The inclusion criteria for respondents in this study were primiparous and/or multiparous mothers; mothers who had given birth to a healthy, singleton, term baby; mothers not using other medications to increase breast milk production; and mothers who were willing to participate. Exclusion criteria included mothers with breast problems, such as flat or inverted nipples and a history of breast surgery; mothers experiencing severe complications requiring hospitalization; mothers with diabetes mellitus and/or hypertension; and mothers who smoked or consumed alcohol.

Data processing in this study was conducted using the SPSS software package, including descriptive (univariate) and bivariate analysis. The collected bivariate analysis was tested using parametric or nonparametric tests, depending on the results of the normality test for the research data.

RESEARCH RESULTS

Respondent Characteristics

In both groups, the average maternal age was within the ideal reproductive age range. This indicates that maternal age was not a factor influencing the difference in breast milk production between the two groups. In both groups, the percentage of multiparous mothers was similar. Due to previous breastfeeding experience, multiparous mothers tend to have more stable breast milk production. Both groups were categorized as having a normal BMI—mildly overweight. Relatively comparable nutritional status indicates that maternal nutritional status was not a major differentiating factor in breast milk production in the two groups. The ability to receive breastfeeding instructions was similar in both groups because most mothers in both groups had at least a high school education.

Table 1
Respondent Characteristics

Characteristics	Treatment (n=16)	control (n=16)
Maternal age (years), mean ± SD	28,0 ± 4,0	28,4 ± 3,7
Paritas (≥2), n (%)	7 (43,8%)	8 (50,0%)
IMT (kg/m²), mean ± SD	24,3 ± 2,9	24,7 ± 3,0
Education ≥ SMA, n (%)	10 (62,5%)	9 (56,3%)
Berat lahir bayi (g), mean ± SD	3120 ± 320	3050 ± 340

Laboratory Test Result

Table 2
Summary of Laboratory Test Results

Parameters	Avarage Fried ± SD	Avarage Frozen ± SD / Raw
Protein (%)	8,64 ± 0,00	8,72 ± 0,08
Zat Besi (Fe) (mg/100g)	13,37 ± 0,78	15,40 ± 0,04
Saponin (%)	2,49	3,92 (Raw)

Table 1 shows the results of laboratory analysis of nugget samples made from tempeh, spinach, and fenugreek seeds (two samples of fried nuggets, two samples of frozen nuggets, and raw nuggets for saponin) showing varying levels of protein, iron, and saponin. On average, the protein content of fried nuggets was 8.64 ± 0.00%, while frozen nuggets were 8.72 ± 0.08%. The Fe content in fried nuggets was 13.37 ± 0.78 mg/100g, while frozen nuggets were 15.40 ± 0.04 mg/100g. Analysis of saponin levels showed that raw nuggets had a content of 3.92% and decreased to 2.49% after frying.

Analysis Results

Table 3
Breast milk volume analysis test

Volume Asi	Treatment		Control	
Increase	15	94%	7	44%
Decrease	1	6 %	9	56%

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Table 4
Breast milk volume analysis test

Group	Volume ASI PRE (Mean ± SD)	Volume ASI POST (Mean ± SD)	Selisih (Mean)	Nilai p
Treatment	515,7 ± 19,0 ml/day	577,5 ± 79,7 ml/day	+61,8 ml	0,000
Control	508,7 ± 8,5 ml/day	509,7 ± 36,1 ml/day	+0,94 ml	0,906

Based on the table, the treatment group showed a significant increase in breast milk volume after receiving the nugget intervention. The average breast milk volume increased from 515.7 ± 19.0 ml/day to 577.5 ± 79.7 ml/day, with a mean difference of +61.8 ml/day. The Wilcoxon Signed Rank Test yielded a p-value of 0.000 ($p < 0.05$), indicating that this difference was statistically significant. This indicates that the treatment successfully increased breast milk production in breastfeeding mothers. This significant increase in breast milk volume can provide more optimal nutritional intake for infants, potentially improving their nutritional status.

In contrast, in the control group, the mean breast milk volume increased only slightly from 508.7 ± 8.5 ml/day to 509.7 ± 36.1 ml/day, with a mean difference of +0.94 ml/day. The paired t-test showed $p = 0.906$ ($p > 0.05$), indicating that the increase was not statistically significant. This means that there was no significant change in breast milk production in the control group.

CONCLUSION

Protein Content

The analysis results showed that the protein content of nuggets in the fried group was 8.64 ± 0.00%, while the frozen nuggets were 8.72 ± 0.08%. This difference indicates that processing techniques can affect the protein content of the final product, which is consistent with previous studies showing that processing can impact the proximate value of a food product. (Rohmatika & Umarianti, 2018) Based on SNI 7758:2013 concerning Chicken Nuggets, the minimum required protein content is 12% on a dry basis. Although this product is made from tempeh, a protein value of 8.6–8.7% on a wet basis is considered good for a food source of vegetable protein. If calculated on a dry basis, the protein content is likely to be higher and closer to the SNI standard. This study is in line with Pratiwi et al. (2022) that spinach fortification in processed products can increase protein content by 5–10% compared to unfortified controls, indicating that the combination of spinach and tempeh provides benefits as a mutually supportive source of vegetable protein. In addition, there was no significant difference between fried and frozen nuggets ($p=0.41$), indicating that the frying process does not significantly reduce protein content and protein tends to decrease (Nursetiani & Herdiana, n.d.) at temperatures <180°C. (Nursetiani & Herdiana, n.d.)

Iron (Fe) Content

According to the results of the nugget analysis conducted in the analytical laboratory of the Faculty of Mathematics and Natural Sciences, University of Mataram, the iron content in fried nuggets was 13.37 ± 0.78 mg/100g, while in frozen nuggets it was 15.40 ± 0.04 mg/100g. This indicates that freezing can maintain or even increase the availability of iron in a product. Iron is an essential mineral that is important for preventing anemia, especially in pregnant women and children, and increasing its levels is highly relevant in the context of prevention. (Nurwulan et al., 2024; Okinarum et al., 2020; Rimawati et al., 2018) Other studies have also confirmed that increasing iron levels in plant-based food products can optimize nutritional intake in at-risk groups. (Dewi & Astriana, 2022; Masfufah et al., 2023) Based on the 2020 Recommended Dietary Allowance (RDA) for breastfeeding mothers (19–49 years), the daily iron requirement is 9 mg/day. Thus, 100 grams of this product can contribute ≥150% of the RDA, so it can be a significant source of iron to prevent anemia. Research by Akbağ et al. (2022) on fenugreek seed supplementation in dairy goats showed an increase in iron levels and milk production. The results of this study support the literature that fenugreek is a good source of heme and non-heme iron. The difference in iron levels between fried and frozen nuggets was not significant ($p=0.17$), but there was a tendency for Fe levels to be higher in frozen products. This can be explained by the report of Trivedi et al. (2007) which stated that heating with oil can cause the oxidation of Fe^{2+} ions to Fe^{3+}, thereby reducing iron bioavailability.

Saponin Levels

According to the results of nugget testing in the analytical laboratory of the Faculty of Mathematics and Natural Sciences, University of

Mataram, the saponin content in raw nuggets was 3.92%, while in fried nuggets it was 2.49%. This decrease indicates that the heating process can reduce the content of these bioactive compounds, which have functional benefits, including potential as cholesterol-lowering agents and antioxidants. (Lombu et al., 2015; Sari et al., 2021). Saponins are bioactive compounds that act as lactagogums, increasing the secretion of prolactin and oxytocin, which play a role in breast milk production (Maurya, 2024). Research by Mangalik & Hesty (2019) showed that administration of fenugreek powder significantly increased prolactin levels in lactating rats. A decrease in saponin levels due to frying was also reported by Yulilania et al. (2021), who found that heating at high temperatures can cause saponin degradation by up to 30–40%. Therefore, consuming nuggets frozen or with minimal cooking is recommended to maintain saponin levels. (Mangalik & Hesty Suryani, 2019; Yulilania Okinarum et al., n.d.) Overall, the protein and iron content of the product met the requirements for nutritious food according to the literature (protein >7%, iron >6 mg/100g). These results support the research hypothesis that fortification of spinach and fenugreek seeds can increase the nutritional value of food products, particularly iron content, which is important for breastfeeding mothers. Therefore, fortified nuggets are suitable for use as an intervention product to support increased breast milk production and infant nutritional status.

Breast Milk Volume Analysis Results

According to Table 2, the average breast milk volume in the treatment group before the intervention was 515.7 ml/day with a standard deviation of 19.0. However, after administering the probiotic preparation of Rhizopus oryzae, it increased to 577.5 ml/day with a standard deviation of 79.7, representing an increase of +61.8 ml/day. With a p-value of 0.000 from the statistical test, it can be concluded that there was a significant difference between breast milk volume before and after treatment. These data demonstrate that administering the probiotic preparation of Rhizopus oryzae significantly increased breast milk production. In contrast, the control group showed a change in breast milk volume before the intervention of 508.7 ± 8.5 ml/day and after the intervention of 509.7 ± 36.1 ml/day, with a difference of +0.94 ml/day and a p-value of 0.906. This indicates that there was no significant increase in breast milk volume in the group not receiving probiotics.

Changes in breast milk volume in the treatment group are thought to be influenced by the bioactive content of the processed probiotic Rhizopus oryzae, which has the potential to improve gut microbiota balance, increase nutrient absorption, and stimulate the secretion of the hormones prolactin and oxytocin. These two hormones play a crucial role in lactogenesis and the milk-let-down reflex. Furthermore, the enzymatic activity of Rhizopus oryzae during the fermentation process can increase the availability of essential amino acids, bioactive peptides, and isoflavone compounds, which have lactagogic effects. This research aligns with findings that probiotic consumption can increase the quantity and quality of breast milk by improving the health of the digestive tract and the immune system of breastfeeding mothers. Probiotics are known to reduce oxidative stress and improve metabolic status, which impacts lactation hormones.

The use of spinach and fenugreek seeds in nugget products shows significant potential to improve the quality of consumed nutrition, particularly in the context of stunting prevention. The right nutritional composition, indicated by optimal protein and iron levels, can support healthy growth and development in children. Therefore, the development of fortified plant-based products must continue to support the fulfillment of the community's nutritional needs. (Hanafi et al., 2016; Masfufah et al., 2023).

The significant increase in breast milk production in the treatment group illustrates the importance of the intervention. Previous research has shown that consuming nutrient-rich foods or supplements can help increase breast milk production. For example, research by Harahap et al. showed that dietary interventions containing increased components such as protein, healthy fats, and B vitamins can stimulate breast milk production. (Harahap et al., 2024) These findings align with the theory of lactation physiology, which states that stimulation with nutritious foods can trigger the secretion of the hormones prolactin and oxytocin, which play a crucial role in breast milk production. (Astari & Hardianti, 2022; Rilyani & Wulandasri, 2020) In addition, psychological aspects such as calmness and social support are also thought to contribute to increased breast milk volume. (Kambera et al., 2021)

CONCLUSION

Thus, it can be concluded that administering processed probiotic Rhizopus oryzae significantly increases breast milk production in breastfeeding mothers compared to the untreated control group. This intervention has the potential to be a natural

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alternative to support programs to increase exclusive breastfeeding success and prevent stunting from an early age.

SUGGESTION

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