

Effect of *Moringa oleifera* Leaf and *Arachis hypogaea* Flour Biscuit Supplementation on Breast Milk Production in Breastfeeding Mothers

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ABSTRACT

Background: Breastfeeding mothers often experience problems in providing exclusive breastfeeding, one of which is complaints about insufficient milk production. One safe and easy-to-use non-pharmacological treatment is moringa leaves and peanuts, which contain flavonoids and essential minerals that stimulate the production of the hormones oxytocin and prolactin. This study aimed to determine the effectiveness of supplementing Moringa leaf and peanut flour biscuits on breast milk production in breastfeeding mothers.

Subjects and Method: This study used a quasi-experimental design with a pretest-posttest with control group design. The study location was in the community of Palu health office. Data collection was conducted from October to November 2025. The study consisted of two groups: an intervention group receiving 100 g of moringa leaf and peanut flour biscuits once daily for 14 days, and a control group receiving nutrition education for breastfeeding mothers. The dependent variables were infant weight, bowel movements, and urination. The independent variables were supplementation with moringa leaf and peanut flour biscuits and nutrition education for breastfeeding mothers. The analysis technique used was Friedman and Man Whitney.

Results: The average weight of infants in the intervention group after being given moringa leaf and peanut flour biscuit supplementation was higher (Mean = 3775.1; SD = 455.5) than before the intervention (Mean = 3353.5; SD = 442.2) and was statistically significant ($p < 0.001$). The average number of bowel movements in the intervention group after being given moringa leaf and peanut flour biscuit supplementation was higher (Mean = 3.6; SD = 0.50) than before the intervention (Mean = 2.95; SD = 0.51) and was statistically insignificant ($p = 0.305$). The average number of urinations in the intervention group after being given moringa leaf and peanut flour biscuit supplementation was higher (Mean = 6.75; SD = 0.91) than before the intervention (Mean = 5.50; SD = 0.607) and was statistically significant ($p = 0.015$).

Conclusion: Supplementation with moringa leaf flour biscuits and peanuts has been proven effective in increasing breast milk production in breastfeeding mothers, making it a safe and practical non-pharmacological therapy alternative.

Keywords: biscuits, peanuts, breast milk production, supplementation, moringa leaf flour.

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BACKGROUND

Insufficient breast milk production is one of the main obstacles to providing exclusive breastfeeding, thus contributing to the low coverage of exclusive breastfeeding (Alindawati et al., 2021). Breast milk is the primary and best source of nutrition for babies because it contains complete and ideal nutrients to support their growth and development. During the first six months of life, breast milk is able to meet all of a baby's nutritional needs (Irmawati et al., 2025). The low coverage of exclusive breastfeeding contributes to cases of stunting in toddlers, while breast milk provided appropriately can maintain nutritional balance and support optimal child growth (Irmawati et al., 2024). According to WHO data, the highest incidence of stunting for the 2-5 year age group is in Asia, with Southeast Asia in second place with 11.6% of cases (WHO, 2025). WHO targets exclusive breastfeeding of 75% by 2030 (Sirait et al., 2022).

According to WHO globally, the coverage of exclusive breastfeeding in the first 6 months of life has increased by 10 points in the last decade and will reach 48% in 2023 (UNICEF and World Health Organization, 2023). Based on data from the 2024 Indonesian Nutritional Status Survey (SSGI), the national proportion of toddlers aged 0-5 months who received breast milk was 66.4% (Badan Kebijakan Pembangunan Kesehatan, 2025). This achievement is considered not optimal when compared to the 80% target set in Presidential Regulation of the Republic of Indonesia Number 72 of 2021 concerning the Acceleration of Stunting Reduction, which states that the exclusive breastfeeding target is 80% (BPK,

2021). According to data from the Central Sulawesi Provincial Health Office Profile, the coverage of exclusive breastfeeding in the last three years has shown a fluctuating pattern, in 2022 it was 54%, in 2023 it remained at 54% and in 2024 it became 63.1% (Dinas Kesehatan Provinsi Sulawesi Tengah, 2025). In this regard, the Palu City Health Office has formulated a Strategic Plan (Renstra) as a manifestation of the implementation of the Mayor of Palu's vision, namely to develop Palu City within the context of sustainable development based on local wisdom, as outlined in Mayoral Regulation No. 49 of 2021 concerning strengthening the Community Economy through moringa cultivation in Palu City. This is due to the significant benefits of the moringa tree as part of daily life as a raw material for food, medicine, and as a commodity for trade. Palu City presents the PAKKULI Innovation, an acronym for Palu, the Indonesian Moringa City (Badan Kebijakan Pembangunan Kesehatan, 2024).

Suboptimal breast milk production is one of the main obstacles in achieving the 80% exclusive breastfeeding coverage target, as stipulated in the Decree of the Minister of Health of the Republic of Indonesia No. 1457/MENKES/SK/X/2003 concerning Minimum Service Standards in the Health Sector. WHO data from 2024 shows that globally only around 48% of infants aged 0-5 months are exclusively breastfed, while in Indonesia exclusive breastfeeding coverage has only reached around 66.4%, still below the national target. This condition indicates the need for effective interventions to support increased breast milk production and the success of

exclusive breastfeeding. Breast milk production is influenced not only by the psychological condition and stimulation of the baby's sucking, but also by the mother's dietary intake. Thus, the type of food consumed by breastfeeding mothers plays a major role in determining the smooth production of breast milk, which often becomes an obstacle to breastfeeding (Nurlaily et al., 2022). For breastfeeding mothers, protein is an essential nutrient to consider. Every 100 ml of breast milk contains approximately 1.2 grams of protein, so an additional intake of approximately 20 grams of protein per day is necessary during breastfeeding. This requirement increases due to its role in milk protein formation and the production of the hormones prolactin and oxytocin. The best sources of plant-based protein can be found in grains, including peanuts, soybeans, and corn (Melawati and Umairo, 2023).

The process of breast milk production occurs through two mechanisms: secretion and synthesis. The synthesis mechanism is the process of breast milk production that is highly dependent on the availability of nutrients, including protein, carbohydrates, minerals, vitamins, and fats. Peanuts, which are rich in vitamins and minerals, can be an important source to support the provision of materials in the breast milk synthesis process (Alindawati et al., 2021). Nutritionally, peanuts are rich in vegetable fat (40–50%), protein (25–30%), and carbohydrates (12%). Their nutritional content is complemented by various vitamins, namely vitamins A, B, C, D, E, and K. In addition, peanuts also contain other important minerals, namely chloride, magnesium, phosphorus, potassium, iron, and sulfur (Utary et al., 2019). Therefore, consuming peanuts provides two main benefits: they can help stimulate hormone production, such as oxytocin, which plays a vital role in lactation, and they provide the substrate necessary for

milk synthesis in the alveolar glands. Based on research results (Melawati and Umairo, 2023) it was found that as many as 80% of breastfeeding mothers experienced an irregular breast milk production process before consuming peanut extract, but after the intervention, all mothers (100%) showed smooth breast milk production.

Apart from peanuts, plants that contain lactagogum compounds are *Moringa* leaves (*Moringa oleifera*), *Moringa* leaves (*Moringa oleifera*) are known to contain natural galactagogue compounds such as flavonoids, phytosterols, and vitamins A, C, as well as calcium and iron minerals which play a role in increasing breast milk secretion (Lestari et al., 2025). *Moringa* leaves are known as a plant with abundant nutritional content and benefits, therefore, this plant is often nicknamed the Miracle of Tree and Mother's Best Friend (Kuswanto et al., 2020).

Moringa oleifera leaves in Indonesia contain high levels of phytosterols, including stigmasterol, sitosterol, and cholesterol, which are steroid compounds. These phytosterols can increase estrogen production, which in turn stimulates the mammary glands in the process of breast milk production (Wahidah et al., 2023b). Certain plants such as klabet leaves (*Trigonella graecum* L.), katuk leaves (*Sauropus androgynus*), and bangun-bangun leaves (*Coleus amboinicus*), have traditionally been believed to be able to increase the production and quality of breast milk (Nasution, 2021).

Several previous studies have highlighted the use of moringa leaves to support breast milk production. Kuswanto's research, for example, demonstrated that moringa leaves are rich in protein, minerals, and phytopharmaceuticals, which play a vital role in breast milk production (Kuswanto et al., 2020). Meanwhile, in other research by (Puspitadini and Budiono,

2023) about the substitution of moringa leaf flour (*Moringa oleifera* Leaf) and green beans (*Vigna Radiate*) in cookies as an alternative supplementary food for breastfeeding mothers, it was found that in 100 grams of moringa leaf flour and green beans, this weighs about 7-8 grams, each piece contains 7.55 grams of protein, while according to the average calculation of the need for snack nutrients for breastfeeding mothers in a day, namely 12.6 grams of protein, so it is recommended to consume 10-12 pieces of moringa leaf and green bean cookies / day, this is calculated based on the number of nutritional adequacy figures (AKG) of snack foods is 20% of daily energy needs per day. And in the study (Alindawati et al., 2021) showed the effect of giving moringa leaf extract cookies for 14 days to postpartum mothers on increasing breast milk production in the treatment group by 112.5 mL and in the comparison group by 45 mL ($p=0.001$). Moringa (*Moringa oleifera*) leaves in extract form can be processed into local food that has the potential to be used in culinary dishes for breastfeeding mothers while supporting their nutritional adequacy (Nasution, 2021). In modern life, the need for convenient foods has made biscuits an alternative nutritional innovation with the potential to help increase breast milk production in breastfeeding mothers.

Based on the non-pharmacological methods for increasing breast milk production mentioned above, researchers focused their study on the effects of providing plant-based supplements, namely moringa leaves and peanuts, in the form of biscuits, as a nutritional supplement for breastfeeding mothers. While extensive research has been conducted on the use of moringa leaves to increase breast milk secretion, studies involving peanuts are limited. Therefore, further research is needed to further examine the potential of peanuts scientifically in greater

depth to explore the potential of these two ingredients as alternative ingredients for supplementation for breastfeeding mothers to increase breast milk production and as an innovation to support the success of exclusive breastfeeding.

SUBJECTS AND METHOD

1. Study Design

This study used a quasi-experimental design with a pretest-posttest control group design. The study was conducted in the Palu City Health Office working area. Data collection was conducted from October to November 2025.

2. Population and Sample

The target population was breastfeeding mothers in the Palu City Health Office's working area. The total sample size was 40 breastfeeding mothers.

3. Study Variable

The dependent variables studied were the baby's weight, bowel movements and urination, and the independent variables were supplementation with moringa leaf and peanut flour biscuits and nutrition education for breastfeeding mothers.

4. Operational Definition of Variable

Supplementation of moringa leaf and peanut flour biscuits is the provision of moringa leaf and peanut flour biscuits as a supplement of 100g for breast milk production in breastfeeding mothers once a day for 14 days. Baby's weight is the weight measured before giving biscuit supplementation and post supplementation, namely every 7 days of treatment and repeated up to 3 times the measurement. Baby's bowel movement is the frequency of baby's bowel movements in 24 hours. Baby's urination is the frequency of baby's urination in 24 hours.

5. Study Instrument

The baby's weight is measured using a digital scale. The baby's bowel movements

and urination are measured using an observation sheet.

6. Data Analysis

The data analysis used is Excel and with the help of the SPSS program. The average difference between paired groups was tested using the Friedman and Man Whitney.

7. Research Ethics

Research ethics issues, including informed consent, anonymity, and confidentiality, were carefully addressed throughout the research process. A research ethics approval letter was obtained from the Research Ethics Committee of the Ministry of Health Polytechnic of Semarang, Indonesia, No. 1226/EA/F.XXIII.38/2025, on October 30, 2025.

RESULTS

Table 1 shows the characteristics of the respondents. Regarding contraceptive use, almost all respondents did not use contraceptives (85%) in the intervention group and 80%) in the control group. Regarding

breastfeeding frequency, most respondents breastfed frequently (60%) in the intervention group and 65%) in the control group. Regarding rest patterns, most respondents had adequate rest (55%) in the intervention group and 60%) in the control group. Regarding psychological status, almost all respondents had normal psychological status (85%) in the intervention group and 90%) in the control group. Regarding lifestyle characteristics, almost all respondents had a healthy lifestyle (90%) in the intervention group and 90%) in the control group.

Table 2 shows an analysis of the effect of moringa leaf and peanut flour biscuit supplementation on breast milk production based on infant weight categories. After the intervention, the difference in average infant weight gain in the intervention group (mean = 421.6; SD = 93.5) was greater than in the control group (mean = 293.1; SD = 74.2) and was statistically significant (p<0.001).

Table 1. Sample Characteristics

Characteristics	Intervention		Control		p
	n	%	n	%	
Contraceptive Use					
Used	3	15	4	20	0.419
Not used	17	85	16	80	
Breastfeeding Frequency					
Rarely	8	40	7	35	0.534
Often	12	60	13	65	
Mother's Rest Pattern					
Sufficient	11	55	12	60	0.555
Not enough	9	45	8	40	
Mother's Psychological Status					
Normal	17	85	18	90	0.351
Referral Required	3	15	2	10	
Lifestyle					
Unhealthy Lifestyle	2	10	1	5	0.239
Healthy Lifestyle	18	90	19	95	

Table 3 shows the effect of moringa leaf and peanut flour biscuit supplementation on breast milk production based on infant bowel movement categories. The

difference in average bowel movement in the intervention group (Mean=0.65; SD=0.67) was greater than the control group (Mean= 0.45; SD=0.60) and was not statistically

significant (p=0.305).

Table 4 shows the effect of moringa leaf and peanut flour biscuit supplementation on breast milk production based on infant bowel movement categories. The

difference in average bowel movement in the intervention group (Mean=1.25; SD=0.716) was greater than the control group (Mean=0.65; SD=0.74) and was statistically significant (p=0.015).

Table 2. Analysis of the effect of moringa leaf and peanut flour biscuit supplementation on breast milk production based on infant weight category

Infant Weight	Mean	SD	P ^a	Difference		P ^b
				Mean	SD	
Intervention						
Pre	3353.5	442.2				
Post1	3558.9	462.5	<0.001	421.6	93.5	<0.001
Post2	3775.1	455.5				
Control						
Pre	2953.6	356.4		293.1	74.2	
Post1	3102.9	358.5	<0.001			
Post2	3246.7	362.4				

^aFriedman test, ^bMann Whitney test

Table 3. Analysis of the effect of moringa leaf and peanut flour biscuit supplementation on breast milk production based on infant stool categories

Infant Stool	Mean	SD	P ^a	Difference		P ^b
				Mean	SD	
Intervention						
Pre	2.95	0.51				
Post1	3.15	0.36	<0.000	0.65	0.67	0.305
Post2	3.6	0.50				
Control						
Pre	3.00	0.72		0.45	0.60	
Post1	3.15	0.67	0.011			
Post2	3.45	0.51				

^aFriedman test, ^bMann Whitney test

Table 4. Analysis of the effect of moringa leaf and peanut flour biscuit supplementation on breast milk production based on infant urination categories

Infant Urination	Mean	SD	P ^a	Difference		P ^b
				Mean	SD	
Intervention						
Pre	5.50	0.60				
Post1	6.40	0.99	<0.001	1.25	0.71	0.015
Post2	6.75	0.91				
Control						
Pre	6.05	0.82		0.65	0.74	
Post1	6.50	1.05	<0.001			
Post2	6.70	0.86				

^aFriedman test, ^bMann Whitney test

DISCUSSION

1. Effect of Moringa Leaf and Peanut Flour Biscuit Supplementation on Breast Milk Production Based on Infant Weight Category

The analysis showed a significant increase in body weight in both the intervention and control groups ($p < 0.001$). This aligns with literature indicating that *Moringa oleifera* is rich in phytosterols, iron, calcium, and galactagogue compounds, which play a role in increasing prolactin and oxytocin, two hormones important in breast milk production (Divya et al., 2024). This study shows an increase in body weight from pre-test to post-test 2 in line with the research conducted (Pujiastuti et al., 2022) Research shows that giving *Moringa oleifera* cookies for 14 days has the potential to increase breast milk production. The healthy fat and protein content of peanuts (*Arachis hypogaea*) also contributes to the quality of breast milk production, thus supporting infant weight gain, as demonstrated in research conducted by (Batubara and Siregar, 2021) that giving peanut extract has an effect on breast milk production. And research (Wahidah et al., 2023a) which showed that administering moringa leaf extract affected breast milk production in breastfeeding mothers based on the infant's weight category.

Infant weight gain in early life is greatly influenced by the adequacy and quality of breast milk. Breast milk is the sole primary source of nutrition for newborns, so the nutritional status of breastfeeding mothers plays a crucial role in determining breast milk production, volume, and composition. The mother's nutrition directly contributes to the nutritional content of breast milk, such as fat, protein, lactose, vitamins, minerals, and bioactive compounds that support the baby's growth and development (Fungtammasan and Phupong, 2021).

Mothers with adequate daily energy intake tend to produce a consistent volume of breast milk. The energy and fat in breast milk are the primary sources of calories for babies, thus supporting physiological weight gain. The fat content of breast milk, particularly long-chain polyunsaturated fatty acids (LCPUFA), plays a crucial role in tissue growth and metabolism, enabling babies to achieve weight gain according to the growth curve (Ammar et al., 2025).

In addition, breast milk quality is influenced by the mother's protein intake, which is necessary for the formation of breast milk's structural components. Micronutrients such as iron, calcium, B-complex vitamins, and folate also play a role in metabolic processes and maintain optimal breast milk composition (WHO, 2023). Maternal nutrition also influences the production of the hormones prolactin and oxytocin. A balanced diet, adequate hydration, and the consumption of galactagogues such as moringa leaves, peanuts, and grains have been reported to increase the milk let-down reflex, thus maximizing breast milk intake (Neville, 2023).

When a baby receives adequate breast milk, their energy needs are met, resulting in normal weight gain. Conversely, mothers with inadequate nutritional intake, stress, or poor breastfeeding techniques can experience decreased milk production. This results in low breast milk intake, which can lead to inadequate weight gain or growth faltering (Fungtammasan and Phupong, 2021). Thus, the nutritional needs of breastfeeding mothers are closely linked to their infant's weight gain. Adequate maternal nutrition is not only crucial for the mother's own health but also a determining factor in successful lactation and infant growth (Puspitadini and Budiono, 2023).

Based on the description above, the researcher assumes that providing

supplemental biscuits made from *Moringa oleifera* leaf flour and peanuts (*Arachis hypogaea*) is effective in increasing breast milk production based on the increase in the baby's weight.

2. Effect of Moringa leaf and peanut flour biscuit supplementation on breast milk production based on infant stool

There is no significant difference between the two groups in the frequency of infant bowel movements. This aligns with research conducted by (Pujiastuti et al., 2022) reported increased breast milk production according to several indicators, but some outcomes, such as changes in infant weight, did not show significant differences between the intervention and control groups, according to the study's results table. In other words, some parameters remained insignificant despite indications of increased production.

The results showed that administering moringa leaf biscuits did not significantly affect the study variable of infant bowel frequency between the intervention and control groups. This insignificance may be due to the biscuit product's processing (baking at high temperatures) which can reduce the levels of several bioactive compounds (phytosterols, vitamin C, flavonoids). This can lead to an ineffective dose, resulting in an insignificant galactagogue effect (Fungtammasan and Phupong, 2021).

This research is in line with research (Wahidah, Ningtyas and Latifah, 2023a) which shows that giving Moringa leaf extract does not affect breast milk production in breastfeeding mothers based on the category of bowel movements. And research (Johan, Anggraini and Noorbaya, 2019) The highest mean defecation frequency was observed in the first week of life, then decreased over subsequent ages across all feeding groups.

Newborns generally have suboptimal lactation activity, limiting their ability to hydrolyze lactose in breast milk and formula. This condition increases osmolarity in the small intestinal lumen, leading to increased defecation frequency. Therefore, exclusively breastfed infants tend to have a high frequency of bowel movements, typically 3-4 times daily.

The above explanation indicates no significant difference between the intervention and control groups in the effect of *Moringa oleifera* (*Moringa oleifera*) and peanut (*Arachis hypogaea*) biscuit supplementation on breast milk production in breastfeeding mothers, based on infant bowel movement frequency.

Bowel movement frequency in exclusively breastfed infants is an indirect indicator of adequate breast milk intake. Infants receiving sufficient breast milk generally have more frequent bowel movements, especially between 0 and 6 weeks of age, because breast milk is easily digested, contains high levels of lactose, and contains bioactive components that stimulate bowel movements. Therefore, changes in the frequency of a baby's bowel movements are often used to assess whether the baby is receiving adequate breast milk (UNICEF & WHO, 2023). Breast milk production and quality are greatly influenced by the nutritional status and diet of the breastfeeding mother. Mothers who consume a balanced diet that includes carbohydrates, protein, healthy fats, vitamins, minerals, and sufficient fluids tend to produce sufficient breast milk. Energy and fluid intake play a crucial role in maintaining breast milk production, while the fat and lactose in breast milk influence the consistency and volume of the baby's stool (Balde et al., 2025).

Lactose in breast milk, the main carbohydrate component, is osmotic, thus increasing the baby's bowel movements.

When the mother has adequate energy intake, breast milk production tends to increase, and the lactose content remains optimal. This results in more frequent bowel movements with yellow, soft, and sour-smelling stools, which are characteristic of exclusively breastfed babies. Therefore, a high bowel movement frequency indicates that the baby's nutritional needs are being met through breast milk (Taylor et al., 2023). Conversely, if the mother's nutritional intake is inadequate, breast milk production can decrease, both in terms of quantity and quality. A decrease in breast milk volume can cause the baby to receive less lactose and fluids, ultimately decreasing the frequency of bowel movements. Infrequent bowel movements do not necessarily indicate a problem, but if accompanied by signs of insufficient breast milk supply, such as inadequate weight gain, it can indicate insufficient breast milk production (Balde et al., 2025).

Several galactagogue foods consumed by mothers, such as moringa leaves, peanuts, grains, and oats, are known to increase breast milk production by stimulating the hormones prolactin and oxytocin. Increased breast milk production due to galactagogue consumption can indirectly increase the frequency of bowel movements in infants because the volume of breast milk received is more optimal. In other words, when maternal nutrition supports breast milk production, the baby receives adequate nutrition, resulting in a more active digestive system and increased bowel movement frequency in line with the physiological patterns of breastfed babies (Fungtamma-san and Phupong, 2021).

3. Effect of Moringa leaf and peanut flour biscuit supplementation on breast milk production based on infant urinary

The analysis results showed a p-value of

0.015, thus concluding that the increase in urinary frequency in the intervention group was significantly greater than in the control group.

This research aligns with other studies (Lestari et al., 2025) The administration of *Moringa oleifera* extract at different doses was effective in increasing breast milk production based on the urination category, all of which were significant in increasing breast milk production. Urinary frequency is one of the most important indicators for assessing the adequacy of breast milk intake in infants. Infants with adequate breast milk intake typically have a urinary frequency of at least 6 times per day, clear urine, and demonstrate good hydration (Ammar et al., 2025). And research (Batubara and Siregar, 2021) studies have shown that peanut extract can increase breast milk production in breastfeeding mothers. Peanuts are rich in nutrients (fat, protein, carbohydrates, vitamins, and minerals), and peanut consumption is thought to support breast milk synthesis by providing the necessary ingredients for breast milk synthesis.

Breast milk production is influenced by the nutritional adequacy of breastfeeding mothers, particularly their intake of fluids, energy, protein, fat, and certain micronutrients. Mothers who consume adequate fluids and nutritious foods will be able to maintain optimal breast milk production. Breast milk contains approximately 87% water, so good maternal hydration status contributes to adequate milk production and maintains the consistency of the fluids received by the baby. When the mother experiences a fluid deficit or inadequate nutritional intake, breast milk volume can decrease, putting the baby at risk of receiving less fluid, which can lead to decreased urination frequency (Cozzella, 2019).

As breast milk production increases, babies receive more fluids, leading to more

frequent and regular urination. Conversely, low urination can be an early sign of dehydration or insufficient breast milk intake. This can occur if the mother is malnourished, stressed, or not consuming foods that support lactation. These conditions reduce breast milk production, leaving the baby with insufficient fluids to meet their physiological needs (Divya et al., 2024).

AUTHORS CONTRIBUTION

In compiling this journal, Eka Nurzam, Marsum dan Irmawati collaborated on the development of the manuscript. Eka Nurzam prepared all research administrative documents (research permits) and data collection. Eka Nurzam, Marsum and Irmawati analyzed, interpreted, and published the data.

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CONFLICT OF INTEREST

There was no conflict of interest.

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