

Effectiveness of Young Papaya Fruit Extract on Prolactin Hormone and Infant Body Weight

Edining Eko Puji Kaptiyanti¹⁾, Sri Sumarni²⁾, Edy Susanto²⁾

¹⁾Applied Master's Program, Postgraduate School, Health Polytechnic, Ministry of Health, Semarang, Central Java, Indonesia

²⁾Health Polytechnic, Ministry of Health, Semarang, Central Java, Indonesia

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ABSTRACT

Background: Breast milk is the best nutrition for infants. Successful exclusive breastfeeding during the first six months of life optimizes growth, cognitive development, and strengthens the infant's immune system. Prolactin, which affects breast milk production, remains a barrier to exclusive breastfeeding. One approach is to utilize natural lactagogic ingredients such as unripe papaya (*Carica Papaya L.*). This study aimed to analyze and demonstrate the effectiveness of unripe papaya extract on increasing prolactin levels and infant weight in breastfeeding mothers.

Subjects and Method: This study used a quasi-experimental design with a two-group pretest-posttest design. The study location was the Danasari Community Health Center, Bojong District, Tegal Regency, Central Java, Indonesia. Data collection was conducted from July to August 2025. A total of 40 subjects were divided into two groups: (1) The intervention group was given 1000 mg/day of unripe papaya extract, Ultra High Temperature (UHT) milk, and boiled eggs for 7 days (n = 20); and (2) The control group received nursing care, UHT milk, and boiled eggs for 7 days (n = 20). The dependent variables were prolactin hormone and infant weight. The independent variables were unripe papaya extract, milk, and boiled eggs. Analysis techniques used were the Wilcoxon test and the Paired Sample T-Test.

Results: The average prolactin hormone level in the intervention group after administration of unripe papaya extract was higher (Mean = 199.70; SD = 72.57) than before the intervention (Mean = 174.50; SD = 64.08) and was statistically significant (p = 0.002). The average infant weight in the intervention group after administration of unripe papaya extract was higher (Mean = 5631.50; SD = 987.73) than before the intervention (Mean = 5313.75; SD = 1025.04) and was statistically significant (p = 0.001).

Conclusion: Administration of unripe papaya extract has been shown to be effective in increasing prolactin hormone levels in breastfeeding mothers and infant weight.

Keywords: young papaya, prolactin hormone, infants weight.

Correspondence:

Edining Eko Puji Kaptiyanti. Applied Master's Program, Postgraduate School, Health Polytechnic, Ministry of Health, Semarang. Jl. Tirta Agung, Pedalangan, Banyumanik, Semarang, 50239, Central Java, Indonesia. Email: kaptiyandining@gmail.com.

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BACKGROUND

Breast milk is mother's milk produced from the mother's mammary glands and exclusive breast milk (breast milk) is given to babies from birth for six months without being replaced with other foods or drinks. Government Regulation Number 33 of 2012 concerning Exclusive Breastfeeding has the aim of ensuring the right of babies to receive exclusive breast milk from birth until the age of six months by considering the growth and development of babies, providing protection to mothers in providing exclusive breast milk to their babies and increasing the role and support of families, communities, Regional Governments, and Central Governments in providing exclusive breast milk (Wahidah et al., 2018).

Based on data, the achievement of exclusive breastfeeding in Indonesia in 2023 reached 68.6% (Kemenkes RI, 2023). Data in Central Java Province reached 80.02%, data in Tegal Regency reached 73.95% (Profil Kesehatan Kabupaten Jawa Tengah, 2023), and data from Danasari Health Center reached 57.03% with 370 cases of stunting (22%) (Dinas Kabupaten Tegal, 2023).

Breast milk is essential for preventing metabolic disorders and enhancing the immune response to infection. The composition of breast milk adapts during infection, providing tailored immune support for the infant and essential for infant development. Therefore, breast milk contributes to infant mortality prevention and overall long-term health (Vassilopoulou et al., 2024).

Physiologically, breast milk production is highly dependent on two main hormones: prolactin and oxytocin. Prolactin plays a central role as a lactogenic hormone, directly responsible for stimulating mammary gland cells to produce milk. High and stable prolactin levels are essential, especially during the early stages of breastfeeding. Low prolactin levels, influenced by various factors

such as stress, suboptimal breastfeeding frequency, or maternal health, are often the root cause of lactation failure or insufficient milk production. Therefore, efforts to increase or maintain prolactin levels are an important focus in lactation interventions (Agustina et al., 2020).

Adequate breast milk production is ensured by optimal prolactin levels, which directly impact infant growth. Stable, on-the-growth weight gain is the most sensitive and objective indicator of adequate nutritional intake and breastfeeding success. Babies who receive adequate breast milk tend to have healthy weight gain and are less likely to develop stunting and malnutrition. When breast milk production is disrupted due to low prolactin or other factors, babies are at risk of slow weight gain or even weight loss, indicating growth failure (Rahayu et al., 2023).

Considering the importance of increasing prolactin levels as an effort to overcome the problem of breast milk production which affects the increase in infant weight, various efforts are being made including the use of food sources based on local wisdom that are lactagogues and have been widely studied for their effects on breast milk production, including *katuk* leaves, moringa leaves, papaya leaves, papaya fruit, banana blossoms, green bean juice, *bangun-bangun* leaves, bitter melon and spinach leaves. Breastfeeding mothers should consume foods that can help increase the hormone prolactin in order to have optimal breast milk production (Larasati et al., 2025).

Young papaya (*Carica Papaya L.*) is a tropical fruit that contains lactagogue. Papaya is very suitable for growing in tropical climates because it requires warm temperatures to thrive. Young papaya contains bioactive compounds such as polyphenols, flavonoids, and alkaloids that have lactagogue effects. These compounds work

by a mechanism similar to dopamine antagonists, which can inhibit dopamine (a hormone that inhibits prolactin) and thus indirectly increase the secretion of the hormone prolactin. Studies show that young papaya (*Carica Papaya L.*) three times daily, as much as 600 grams, for 7 days increases breast milk production in breastfeeding mothers and increases the hormone prolactin, which is very important for facilitating breast milk production (Arlenti and Herlinda, 2021).

Sary et al. (2022) showed that giving young papaya effectively increased breast milk production more than date palm juice. Research also (Mulyaningsih et al., 2023) showed that administering green papaya was more effective in increasing breast milk volume in postpartum mothers than the katuk leaf group.

In the study Andolina et al. (2023) shows that exclusive breastfeeding has no effect on infant weight gain. Research (Anggraeni and Benge, 2022) stated that there is a significant relationship between exclusive breastfeeding and the weight of babies aged 1-6 months. Research also shows that (Siregar and Ritonga, 2020) stated that there is a relationship between exclusive breastfeeding and weight gain in babies aged 0-6 months

Exclusive breastfeeding influences infant growth and development and is a factor that can prevent stunting. This is consistent with research (Rilyani et al., 2021) which shows that there is a significant relationship between exclusive breastfeeding and the incidence of stunting.

In a study that tested the acute toxicity of young papaya fruit water extract (*Carica Papaya L.*) on erythrocyte morphology in white rats (*Rattus norvegicus*) Wistar strain through observation of peripheral blood smears with doses of 50-5,000 mg/kg BW.

The overall results showed that in the observation of peripheral blood smears, there were no changes in erythrocyte morphology in the treatment or control groups. Through observation of peripheral blood smears, it was found that young papaya fruit water extract (*Carica Papaya L.*) did not cause acute toxicity to erythrocyte cell morphology in white rats (*Rattus norvegicus*) Wistar strain (Kharisma et al., 2017).

The toxicity test aims to determine the acute toxicity level of young papaya fruit water extract (*Carica Papaya L.*) in mice. Using the purposed new recommended technique, it shows that throughout the toxicity test stage after 24 hours with doses of 50 to 5000 mg/kg, the test animals did not die or show symptoms of toxicity such as piloerection, nursing, straub, tremors, seizures, increased hindlimb reflexes, and exophthalmos. In the same confirmation test, the test animals did not die and did not show symptoms of toxicity after being given the highest dose of the extract of 5000 mg/kg BW. According to the criteria for the degree of acute toxicity, young papaya fruit water extract has an LD₅₀ of >5000 mg/kg BW, and is categorized as a practically non-toxic substance (PTT) (Nadiyah et al., 2016).

The calculation of the dose of young papaya fruit extract is based on the dose conversion table between types of test subjects according to Laurence and Bacharach (1964) in BPOM Guidelines No. 18 of 2021 with rats as test animals with the calculation of the conversion of test animals (rats) to humans, namely 56 mg/70 kgBW and the weight of test animals (rats) is 200 gr (0.2 kg). The minimum dose produced is 520 mg/65 kgBW and the maximum dose produced is 52,000 mg/65 kgBW (Nadiyah et al., 2016), so the dose used is 1000 mg/65 kgBW.

Government efforts to support exclusive breastfeeding include Government

Regulation No. 33 of 2012 concerning exclusive breastfeeding. It establishes policies for lactation rooms in public places and offices, and allocates a budget for training breastfeeding counselors. In addition to government efforts, the community also participates in supporting the program. One example is the formation of Breastfeeding Support Groups (KP-ASI). Efforts by health workers include providing education on exclusive breastfeeding and proper breastfeeding techniques in prenatal classes, during ANC, and after delivery (Wahidah et al., 2023).

Papaya fruit contains lactagogum and is a tropical fruit easily found in Indonesia. Unripe papaya contains bioactive compounds such as polyphenols, flavonoids, and alkaloids, which are believed to have a lactagogum effect, or stimulate breast milk production. Scientifically, these compounds work through a mechanism similar to dopamine antagonists, which can inhibit dopamine (a hormone that inhibits prolactin), thereby indirectly increasing prolactin secretion. This study aims to analyze the effectiveness of Unripe Papaya Fruit Extract on Prolactin Hormone and Infant Weight.

SUBJECTS AND METHOD

1. Study Design

This study used a quasi-experimental design with a two-group pretest-posttest design. The study was conducted at the Danasari Community Health Center, Bojong District, Tegal Regency. Data collection was conducted from July to August 2025.

2. Population and Sample

The target population was breastfeeding mothers at Danasari Community Health Center. The total sample size was 40 breastfeeding mothers.

3. Study Variable

The dependent variables were the levels of the prolactin hormone in breastfeeding

mothers and the baby's weight. The independent variables were young papaya fruit extract, UHT milk and boiled eggs.

4. Operational Definition of Variable

Young papaya extract is young papaya fruit that has been washed thoroughly with running water, then cut into small pieces and dried at a controlled temperature to reduce the water content. The dried sample is then ground into a fine powder and extracted using a maceration method which is given to breastfeeding mothers once a day as much as 1000mg for 7 days.

Prolactin hormone levels is a hormone that functions to stimulate the mammary glands to produce breast milk, are measured before and after the intervention taken by taking blood samples that are centrifuged to obtain serum which is then examined for prolactin hormone levels in the laboratory.

Infant body weight is the baby's body mass measured using a calibrated baby scale, expressed in grams. Measurements are taken before and after the intervention.

5. Study Instrument

Prolactin hormone levels were measured using an ELISA kit. The baby's weight was measured using a baby scale.

6. Data Analysis

The data analysis used Excel and the SPSS program. The mean differences between paired groups were tested using the Wilcoxon and Paired Sample T-Tests.

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. 940/EA/F.XXIII.38/2025, on July 2, 2025.

RESULTS

Table 1 shows the characteristics of the

respondents. The average maternal age in the intervention group was 28.6 years and the control group was 29.1 years. Regarding infant age, the average infant age in the intervention group was 2.25 months and the

control group was 2.77 months. Regarding infant weight, the average infant weight in the intervention group was 3,194 g and the control group was 3,261 g.

Table 1. Sample characteristics

Characteristics	Intervention		Control		P
	Mean (SD)	Min-Max	Mean (SD)	Min-Max	
Mother's age (years old)	28.6 (5.03)	22-38	29.1 (5.19)	22-39	0.861
Infants age (years old)	2.25 (0.78)	1-3.5	2.775 (1.18)	1-5	0.178
Birthweight (g)	3194 (423.68)	2500-4100	3261 (468.4)	2450-4300	0.819

Table 2 shows an analysis of the effect of young papaya extract on prolactin hormone levels, before and after the intervention. The average prolactin hormone levels before the intervention in the intervention group (mean= 174.50; SD= 64.08) and in the control group (mean= 182.10; SD= 70.16)

and were statistically significant (p <0.001). The average prolactin hormone levels after the intervention in the intervention group (mean= 199.70; SD= 72.57) and in the control group (mean= 172.35; SD= 74.40) and were statistically significant (p <0.001).

Table 2. Analysis of the effect of young papaya extract on prolactin hormone levels in breastfeeding mothers

Prolactin Hormone	N	Mean	SD	P ^a
Pre intervention				
Intervention	20	174.50	64.08	<0.001
Control	20	182.10	70.16	
Post intervention				
Intervention	20	199.70	72.57	<0.001
Control	20	172.35	74.40	

^aMann Whitney

Table 3 shows the effect size of the intervention group compared to the control group on increasing prolactin hormone levels. The average prolactin hormone levels

in the intervention group were (Mean = 25.20; SD = 29.88) and in the control group (Mean = -9.75; SD = 41.69), and statistically significant (p = 0.960).

Table 3. Effect size of intervention group with control group on increase in prolactin hormone

Variable	Group	N	Mean (SD)	*Cohen's d Effect
Prolactin Hormone	Intervention	20	25.20 (29.88)	0.96
	Control	20	-9.75 (41.69)	

*Cohen's d Effect

Table 4 shows the analysis of the effect of young papaya extract on infant weight before and after the intervention. The average infant weight before the intervention in the intervention group was (Mean= 5313.75; SD= 1025.04) and in the control group (Mean= 5679.50; SD=

1076.54), and statistically significant ($p < 0.001$). The average infant weight after the intervention in the intervention group (Mean= 5631.50; SD= 987.73) and in the control group (Mean= 5796.50; SD= 1052.32) was statistically significant ($p < 0.001$).

Table 4. Analysis of the effect of young papaya extract on infant body weight

Prolactin Hormone	N	Mean	SD	P ^a
Pre intervention				
Intervention	20	5313.75	1025.04	<0.001
Control	20	5679.50	1076.54	
Post intervention				
Intervention	20	5631.50	987.73	<0.001
Control	20	5796.50	1052.32	

^aIndependent t-test

Table 5 shows the effect size of the intervention group and the control group on infant weight. The average infant weight in the intervention group was (Mean = 317.75;

SD = 139.42) and in the control group (Mean = 117; SD = 112.53), and the statistically significant effect was very large ($p = 1.58$).

Table 5. Effect Size of Intervention Group with Control Group on Infant Weight

Variable	Group	n	Mean (SD)
Infant Body Weight	Intervention	20	317.75 (139.42)
	Control	20	117 (112.53)

*Cohen's d Effect

DISCUSSION

1. The Effect of Young Papaya Extract on Prolactin Hormone Levels in Breastfeeding Mothers

The analysis showed that the intervention group, which received 1,000 mg of unripe papaya extract daily for seven days, experienced an average increase in prolactin levels of 25.20 ± 29.887 . In contrast, the control group, which received only breastfeeding care and a standard nutritious diet without unripe papaya extract, experienced a decrease in prolactin levels of -9.75 (SD= 41.70). This indicates a significant effect in the intervention group given unripe papaya extract compared to the control group, which did not receive unripe papaya extract,

which experienced a decrease in prolactin levels.

This significant difference reinforces the conclusion that unripe papaya extract acts as an effective lactagogic agent. Unripe papaya extract significantly increased prolactin levels in mothers in the intervention group, ultimately triggering greater and higher-quality breast milk production. This increase in breast milk production is a direct determinant of the infant's increased nutritional intake, which then manifests as more optimal and significant weight gain compared to the control group.

The significant increase in the intervention group is in line with the theory that the bioactive compounds in young papaya,

such as active peptides, polyphenols, and steroids, have agonistic effects on prolactin and oxytocin receptors. These compounds work by stimulating the prolactin reflex and inhibiting dopamine, thereby simultaneously increasing the production of prolactin and oxytocin hormones. Prolactin plays a major role in milk production in the secretory cells of the alveoli, while oxytocin plays a role in milk secretion (milk ejection/ letdown reflex) (Zuhrotunida, 2023).

These results confirm the research (Elo, 2024) which explains that young papaya contains lactagogic compounds, such as the enzyme papain, vitamins, alkaloids, and saponins, which play a role in increasing breast milk production. These active substances can stimulate the hormone prolactin, which is the main hormone responsible for the production and secretion of breast milk. Hormonal factors, especially prolactin and oxytocin, are important determinants of breast milk volume, and consuming young papaya is effective in increasing these hormonal activities so that the flow and volume of breast milk become smoother. Research Arlenti and Herlinda (2021) also found that the polyphenols and steroids in unripe papaya act as lactagogic agents, stimulating the pituitary gland to increase prolactin secretion. Increased prolactin directly influences breast milk production, which in turn can increase infant weight gain. Furthermore, research (Mawaddah, 2024) menyatakan bahwa konsumsi ekstrak daun Unripe papaya effectively increases the prolactin hormone in breastfeeding mothers.

Researchers assume that unripe papaya extract can influence prolactin based on its bioactive compounds, which are known to have lactagogic effects. Compounds such as flavonoids, saponins, and papain can stimulate the neuroendocrine system, which plays a role in lactation.

Through this mechanism, unripe papaya extract is assumed to stimulate increased secretion of prolactin, the primary hormone that regulates breast milk production. Increased prolactin levels will increase breast milk production and flow in breastfeeding mothers.

2. The Effect of Young Papaya Extract on Infant Weight

The analysis showed that the unripe papaya extract intervention had a significant effect on infant weight gain in the intervention group. This was due to increased prolactin levels in mothers, which ultimately increased the volume and quality of breast milk.

Increased prolactin levels in mothers in the intervention group directly triggered more optimal breast milk production, thereby increasing infant nutritional intake. The composition of breast milk, particularly its carbohydrate content in the form of lactose, constantly changes to meet infant nutritional needs during growth and development, one of which is infant weight gain.

These results align with previous research, such as research by (Andolina et al., 2023) which shows that babies who are given exclusive breastfeeding significantly influence the weight gain of babies compared to those who are not given exclusive breastfeeding. Research (Putri et al., 2020) which states that giving young papaya leaves affects the increase in breast milk production and baby weight, and research (Wilda and Sarlis, 2021) which also stated that there was an increase in the average weight of infants after breastfeeding mothers consumed young papaya.

Consuming young papaya effectively increased breast milk production and increased infant weight gain in the intervention group, demonstrating the effectiveness of young papaya extract as a natural lactagogue. Developing a preparation in the form of young papaya extract offers

advantages in terms of dose stability and ease of consumption compared to fresh processed forms such as stir-fries or juices.

The intervention group, given 1000 mg of young papaya extract daily for seven days, recorded an average infant weight gain of 317.75 g (SD= 139.42). This increase far exceeds the minimum ideal daily weight gain for infants aged 0-3 months (approximately 20-30 grams/day) and demonstrates optimal breast milk intake. (Agustina, 2020).

In contrast, the Control Group, which received only breastfeeding and standard nutritional feeding without unripe papaya extract intervention, only experienced an average increase in infant weight of 117 g (SD= 112.53). This increase, while still positive, was substantially lower, indicating that weight gain in this group was more influenced by underlying factors (such as breastfeeding technique and standard nutrition) and not by additional lactagogic factors.

This study provides evidence that while breastfeeding and nutritious feeding are crucial, the addition of unripe papaya extract provides a booster effect that optimizes maternal physiological function (increased prolactin) resulting in significantly superior clinical outcomes for infants (weight gain). These results underscore the potential of unripe papaya extract as a safe, nature-based intervention to address suboptimal infant weight gain.

AUTHOR CONTRIBUTION

In compiling this journal, Edining Eko Puji Kaptiyanti, Sri Sumarni, and Edy Susanto collaborated on developing the manuscript. Edining Eko Puji Kaptiyanti prepared all research administrative documents (research permits) and data collection. Edining Eko Puji Kaptiyanti, Sri Sumarni, and Edy Susanto analyzed, interpreted, and published

the data.

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CONFLICT OF INTEREST

There is no conflict of interest in this study

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