Development of Biscuits from Winged Beans (Psophocarpus tetragonolobus L.) as a Primary Source for Milk Production

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KEYWORDS
Winged Beans, Milk Production, Biscuits, Nutritional Analysis.

ABSTRACT
Background: The high prevalence of stunting, notably in Aceh at 31.2%, highlights the urgent requirement for effective nutrition interventions. Utilizing local resources like winged bean flour in food products can play a vital role in enhancing maternal and infant health, addressing malnutrition, and improving breastfeeding outcomes
Objective: This study aims to develop biscuits from winged beans (Psophocarpus tetragonolobus L.) as a primary source for enhancing milk production. Winged beans are known to be rich in protein and essential nutrients for the health of breastfeeding mothers.
Methodology: This study employs a true experimental design involving clinical trials on rabbits, proximate analysis, and sensory acceptance testing. In the first year, the focus is on developing winged bean biscuit formulas, conducting nutritional and contamination tests, and measuring weight and milk volume in animal trials. The research will take place from March to August 2024 at various locations, including the Nutrition Department at Aceh Health Polytechnic and Syiah Kuala University. In this research, biscuits were produced with varying additions of winged bean flour at 0%, 10%, 15%, and 20% in the biscuit recipe.
Results: The results indicate that biscuits containing winged bean flour can increase milk production in female rabbits and show significant weight gain after biscuit consumption. Proximate analysis reveals good nutritional content, while testing for harmful metal contamination ensures product safety. Organoleptic acceptance testing shows that these biscuits are well-received by consumers. These findings affirm the potential of winged beans as a local food source that can support the health of mothers and children, contributing to efforts to combat malnutrition in Indonesia.
Conclusion:. Biscuit made from winged bean flour can enhance milk production and weight gain in female rabbits, while offering good nutritional content and being free from contamination. These findings support the potential of winged beans as a local food source to address malnutrition in Indonesia.

1. Introduction

According to a survey by the Ministry of Health, the proportion of exclusive breastfeeding for infants aged 6 to 23 months in Indonesia was only 55.5% in 2023(UNICEF Dan WHO .). Exclusive breastfeeding means providing breast milk to infants without any additional foods or drinks, except for medicine or vitamins in syrup form if needed. Nationally, the coverage of infants receiving exclusive breastfeeding in 2021 was recorded at 56.9%(Gayatri, 2021; Idris & Astari, 2023a);. This figure represents a significant achievement, as it surpasses the program target set for 2021, which was 40%(Laksono et al., 2021; Paramashanti et al., 2022). This increase in coverage reflects the efforts of the government and various related institutions in raising public awareness about the importance of exclusive breastfeeding for infant health(Idris & Astari, 2023b; Paramashanti et al., 2022). West Nusa Tenggara Province recorded the highest percentage of exclusive breastfeeding coverage at 82.4%. This indicates the success of health and education programs implemented in the region, including training for health workers and effective information campaigns. In contrast, Maluku Province had the lowest percentage at only 13.0%.

This figure highlights the need for greater attention to improve awareness and access to exclusive breastfeeding in that area. The coverage of exclusive breastfeeding in Aceh in 2021 was recorded at 66.6%, which is still below the national target of 80%. At the district/city level, data from 2021 shows that Langsa City had the highest coverage at 84%, while Aceh Utara District recorded the lowest at 33%. Aceh Barat Daya District also showed a fairly good figure with a coverage of 68%. These differences reflect variations in access to health services, education, and social support available in each area. Additionally, the Indonesian Nutrition Status Survey (SSGI) 2022 provides a more comprehensive overview of the nutritional status of children under five in Indonesia. The measured indicators include stunting, wasting, underweight, and overweight, as well as their determining factors. The prevalence of stunting in Indonesia is recorded at 21.6%, indicating that one in five children under five experiences growth impairment. Aceh Province has a higher prevalence of stunting at 31.2%, while Aceh Barat Daya District reports an even higher rate of 35.2%.

These figures highlight the need for more intensive interventions in nutrition and health programs to prevent

stunting and other nutritional issues, as well as to improve the quality of life for children in these areas. During pregnancy, a mother's body prepares the breasts for producing Breast Milk (ASI), which is the primary food prepared for the baby(Mediawati & Yanuarini, 2023). This process involves important physiological changes to ensure that breast milk production meets the nutritional needs of the infant at birth. One way to support breast milk production is by utilizing natural resources, such as winged bean (Psophocarpus tetragonolobus L.)(Adegboyega et al., 2019; Bepary et al., 2023; Tanzi et al., 2019). Winged bean is a source of high-quality protein, containing essential amino acids comparable to those in soybeans, with higher levels of lysine and cysteine. The development of processed products from winged bean, such as biscuits, can enhance the utilization of this local food source. Biscuit products meet the community's demand for practical and easily accessible food in various sizes. This research aims to analyze the effect of adding winged bean seed flour to biscuits on breast milk production, as well as on the weight gain of mother rabbits and the rabbits being nursed. Specifically, the study includes the production of winged bean seed flour, proximate analysis, analysis of harmful metal contamination, product development of biscuits, product acceptability testing, and measurement of breast milk production quantity and rabbit weight.

2. Methods

The research design employs a true experimental design with three components: a true experiment for clinical testing in the laboratory using rabbits, proximate testing, and analysis of harmful metal contamination, as well as hedonic acceptability testing. The research stages begin in Year 1 with the development of a winged bean biscuit formula, which includes the preparation of winged bean flour, proximate analysis, testing for harmful metal contamination, and organoleptic testing of the biscuits. The study will take place from March 2024 to August 2024, conducted at the Food Technology Laboratory of the Nutrition Department at Poltekkes Kemenkes Aceh for organoleptic testing. Proximate analysis and metal contamination testing will occur at the Banda Aceh Standardization and Industrial Service Testing Laboratory, while the animal trials (rabbits) for measuring breast milk volume, as well as the weight of mother rabbits and their offspring, will be conducted at Universitas Syiah Kuala (USK) Banda Aceh. The subjects of the research include female rabbits obtained from the USK Laboratory, which arehealthy and divided into four groups with different treatments, each consisting of three rabbits.

The first stage involves measuring the rabbits' weight before and after administering the winged bean biscuit extract, followed by the intervention as follows: Group 1 serves as the control group (not given winged bean biscuits), Group 2 receives 10 grams of winged bean biscuits, Group 3 receives 15 grams, and Group 4 receives 20 grams. The recipe for making winged bean biscuits consists of several formulas. Formula 0 does not include winged bean flour and uses 100 g of flour, 50 g of powdered sugar, 20 g of egg yolk, 65 g of margarine, and 15 g of milk powder, resulting in 150 g of biscuits (30 pieces, thickness 0.3 cm). Formula I replaces 10 g of flour with 10 g of winged bean flour, while Formula II uses 15 g of winged bean flour, and Formula III uses 20 g of winged bean flour, with each formula still producing 150 g of biscuits with the same specifications. All of these formulas demonstrate an increased proportion of winged bean flour used in the recipe.

3. Results

The process of making winged bean seed flour begins with sorting the dry winged bean seeds, followed by soaking them for 17 hours and sorting them again after soaking. Next, the seeds are boiled in boiling water for 30 minutes, then cooled before washing. After washing, the seeds are sorted again and dried in the sun for approximately 3 days until completely dry. The dried winged bean seeds are then ground into flour, and finally, the flour is sifted through a 60 mesh sieve. The winged bean seeds used in this study were obtained from seed suppliers in Aceh Besar District, Aceh Province. Based on preliminary test results, the yield of flour produced compared to the initial weight of the winged bean seeds is 40% (Toar Waraney Senduk, et al., 2020).

Results of Laboratory Tests on Winged bean Seeds And Winged bean Seed Flour

Laboratory tests were conducted at the Testing Laboratory of the Banda Aceh Standardization and Industrial Service Center. The tests performed included proximate analysis for winged bean seeds and proximate analysis along with metal contamination testing for winged bean seed flour. The tabulated results are as follows:

Proximate Analysis of Winged bean Seeds

Table 1: Results of Proximate Analysis of winged Seeds

No.	Test Parameter	Test Method	Unit	Test Result
1	Moisture Content	SNI 01-2891-1992	%	12.08
2	Ash Content	SNI 01-2891-1992	%	4.75
3	Protein	SNI 01-2891-1992	%	39.56

4	Fat	SNI 01-2891-1992	%	17.07
5	Carbohydrate	SNI 01-2891-1992	%	18.93
6	Crude Fiber	SNI 01-2891-1992	%	6.61

Source: Laboratory Analysis Results, June 2024

The proximate analysis results of the winged bean seeds above are still below the maximum threshold based on the SNI 01-2891-1992 test method.

Proximate Analysis and Heavy Metal Contamination Test of Winged Bean Flour

Table 2: Proximate Analysis and Heavy Metal Contamination Test Results for Winged Bean Flour

No.	Test Parameter	Test Method	Unit	Test Result
1	Moisture Content	SNI 01-2891-1992	%	9.68 / 12
2	Ash Content	SNI 01-2891-1992	%	3.52 / 10
3	Protein	SNI 01-2891-1992	%	33.84
4	Fat	SNI 01-2891-1992	%	13.21
5	Carbohydrate	SNI 01-2891-1992	%	26.56
6	Crude Fiber	SNI 01-2891-1992	%	6.09
7	Copper (Cu)	SNI 01-2891-1992	mg/kg	17.81
8	Lead (Pb)	SNI 01-2891-1992	mg/L	<0.0002#
9	Mercury (Hg)	SNI 01-2891-1992	mg/L	<0.0005#

Note: # = Below Method Detection Limit

Source: Laboratory Analysis Results, June 2024

The proximate characteristic analysis includes moisture content, ash content, fat content, protein content, carbohydrate content, and crude fiber. Based on the table of proximate analysis results for winged bean seeds and the table for winged bean seed flour, it can be concluded that there is a decrease in the nutritional content (moisture, ash, protein, fat, and crude fiber), while the carbohydrate content increased from 18.93% in winged bean seeds to 26.56% in winged bean seed flour (an increase of 7.63% in carbohydrates). This change is due to the soaking, drying, and grinding processes involved in flour production. The duration of soaking determines the water absorption capacity of the seeds. This is related to texture, as a higher water absorption capacity can reduce hardness; the more water absorbed, the softer and more easily crumbled the product (Hargo Saputro et al., 2014).

Seeds soaked for different durations exhibit physical differences, with increased volume as soaking time increases. This volume increase is caused by water entering the seed tissue during soaking, a process known as imbibition. Imbibition is defined as the diffusion event in plants, marked by the entry of water into intercellular spaces, causing cell walls to expand(Adebo et al., 2022; Kahala et al., 2021; Kitum, 2020). Soaking can dissolve oligosaccharide compounds, such as soluble dietary fiber; however, spontaneous fermentation can lead to the degradation of dietary fiber(Gan et al., 2021).

Natural fermentation of seeds occurs during soaking, indicated by the presence of bubbles in the soaking solution. Excessive fermentation is undesirable as it negatively affects the quality of the resulting flour. Boiling can cause some proteins to deteriorate. The longer the boiling time, the greater the extent of protein damage (Edy et al., 2020). Below is the trend analysis of nutrient values for winged bean seeds compared to winged bean seed flour based on the results of the proximate analysis.

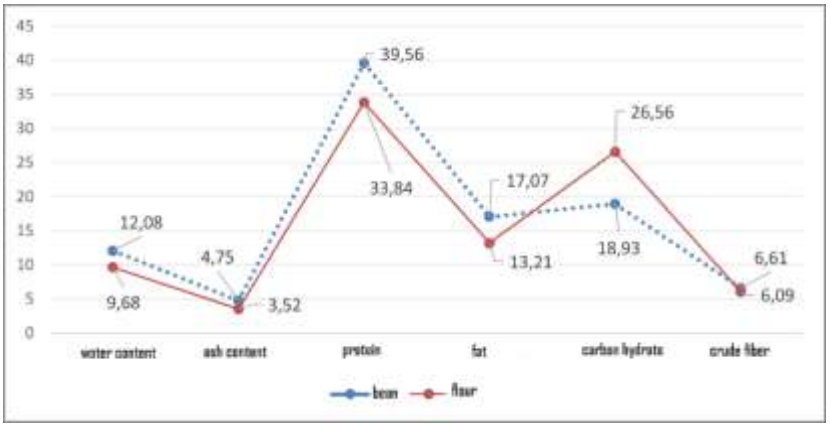

Figure 1: Trend of Nutritional Values for Winged bean Seeds and Winged bean Seed Flour

According to the Food and Drug Supervisory Agency Regulation No. 9 of 2022 concerning Heavy Metal Contaminant Requirements in Processed Foods, products made from cereal seeds, roots, tubers, legumes, and pulp (excluding bakery products) state that the maximum limits for lead (Pb) is 0.25 mg/kg and mercury (Hg) is 0.03 mg/kg. Laboratory test results showed Pb <0.0002# and Hg <0.0005#, concluding that the winged bean seed flour used in biscuit production does not exceed the maximum contamination limits. Additionally, the regulation specifies that the maximum limits for processed foods intended for pregnant and/or breastfeeding women are Pb 0.002 mg/kg and Hg 0.01 mg/kg (with laboratory results showing Pb <0.0002# and Hg <0.0005#). This indicates that the winged bean seed flour used in biscuit production also meets safety standards for heavy metal contamination for pregnant and breastfeeding women (Note: **calculated against ready-to-eat products).

According to the same regulation, copper (Cu) is not included in the list of heavy metal contaminants. Furthermore, the Indonesian Ministry of Health Regulation No. 28 of 2019 regarding Recommended Nutritional Adequacy Figures for the Indonesian population states that copper (Cu) is a nutrient that should be consumed according to the recommended daily mineral intake per person, as follows:

Table 3: Recommended Mineral Intake

Age Group	Recommended Copper (Cu) Intake (mcg)
Infants/Children 0-9 years	200-570
Males 10-80+ years	700-900
Females 10-80+ years	700-900
Pregnant (+ additional)	+100
Breastfeeding (+ additional)	+400

Biscuit Production Process

The process of making biscuits from winged bean seed flour involves establishing the formula used. Based on preliminary studies, four types of formulas were developed, incorporating 0%, 10%, 15%, and 20% winged bean seed flour in a single biscuit recipe. The formulations and ingredients used in the production of these winged bean biscuits are as follows:

Table 4: Winged bean Biscuit Formulas

Ingredients	Formula			
	F0 (0%)	F I (10%)	F II (15%)	F III (20%)
Flour	100	90	85	80
Winged bean Seed Flour	0	10	15	20
Powdered Sugar	50	50	50	50
Egg Yolk	20	20	20	20
Margarine	65	65	65	65
Milk Powder	15	15	15	15
Total Weight	250	250	250	250

After the biscuit production process using an electric oven, the weights of the biscuits from each formula were obtained, which were 150 grams, yielding 30 pieces with a thickness of 0.3 cm. The nutritional values of the biscuits were calculated based on the ingredients used and converted according to the Indonesian Food Composition Table 2018. The results of the calculations and conversions of the nutritional values of the biscuits per 100 grams and per piece are as follows:

Table 5 Nutritional Values of Biscuits per 100 Grams Based on Formula

Nutritional Values	**Formula**			
	FO	**F I**	**F II**	**F III**
Calories	763,97	768,43	770,67	772,90
Moisture Content	23,32	23,18	23,11	23,04
Ash Content	2,75	2,91	3,00	3,08
Protein	10,89	12,55	13,38	14,21
Fat	43,02	43,83	44,24	44,65
Carbohydrates	86,69	83,31	81,62	79,93
Crude Fiber	0,20	0,59	0,78	0,97
Copper (Cu)	0,03	1,22	1,81	2,40

Table 6 Nutritional Values per Biscuit Piece Based on Formula

Nutritional Values	**Formula**			
	F0	**F I**	**F II**	**F III**
Calories	25,47	25,61	25,69	25,76
Moisture Content	0,78	0,77	0,77	0,77
Ash Content	0,09	0,10	0,10	0,10

Protein	0,36	0,42	0,45	0,47
Fat	1,43	1,46	1,47	1,49
Carbohydrates	2,89	2,78	2,72	2,66
Crude Fiber	0,01	0,02	0,03	0,03
Copper (Cu)	0,001	0,04	0,06	0,08

The following is an image of the Winged bean Seed Flour Biscuit product produced, which was used for proximate analysis, organoleptic testing, and testing on female rabbits.

Figure 2: Winged Bean Flour Biscuits

The Effect of Biscuits on Milk Volume and Body Weight in Test Animals

Rabbits are livestock animals with significant reproductive potential, capable of producing multiple offspring in a single litter (4-12 kits) and reaching sexual maturity quickly (4-5 months). They have short birth intervals (4-5 weeks) and a fattening period of just 2 months post-weaning, providing high-quality meat with favorable nutritional profiles (high protein and minerals, low fat and energy) and a wide range of feed utilization(Kitum, 2020). However, mortality rates remain high during the pre-weaning stage, often due to poor mothering ability, cannibalism, disease, and insufficient milk production(Marai & Rashwan, 2003; Rashwan & Marai, 2000a). Efforts to reduce mortality have included the use of feed additives, traditionally antibiotics, which can have adverse long-term effects on both rabbits and humans consuming their meat. Therefore, exploring healthier and safer alternatives is essential. The procedure for measuring milk volume and body weight involved administering biscuits once daily at a rate of 2.33 kg per kilogram of body weight, weighing the female rabbits before and after nursing for 15 days to assess milk volume, and weighing the kits every 5 days during the same period.

Table 7: Milk Volume of Control Female Rabbits

No.	Body Weight (Kg)	Weight Difference	Breast Milk Volume (ml)
	Morning	Evening	
Day I	1.8	1.9	0.1
Day II	2.0	1.8	-0.2
Day III	1.6	1.6	0.0
Day IV	1.5	1.5	0.0
Day V	1.5	1.5	0.0
Day VI	1.4	1.4	0.0
Day VII	1.4	1.4	0.0
Day VIII	1.4	1.5	0.1
Day IX	1.6	1.4	-0.2
Day X	1.6	1.7	0.1
Day XI	1.6	1.4	-0.2
Day XII	1.6	1.5	-0.1
Day XIII	1.6	1.7	0.1
Day XIV	1.7	1.7	0.0
Day XV	1.7	1.6	-0.1

The table above concludes that during the 15-day period of biscuit administration without the addition of winged bean seed flour, there was only 4 days of milk production from the control female rabbits. This data indicates that the addition of winged bean seed flour to the biscuits can enhance milk production in rabbits.

Table 8: Milk Volume of Treated Female Rabbits

No.	Body Weight (Kg)	Weight Difference	Breast Milk Volume (ml)
	Morning	Evening	
Day I	1.5	1.6	0.1
Day II	1.6	1.7	0.1
Day III	1.7	1.6	-0.1
Day IV	1.7	1.8	0.1

Day V	1.6	1.7	0.1
Day VI	1.6	1.7	0.1
Day VII	1.7	1.8	0.1
Day VIII	1.7	1.8	0.1
Day IX	1.8	1.7	-0.1
Day X	1.7	1.7	0.0
Day XI	1.7	1.7	0.0
Day XII	1.7	1.8	0.1
Day XIII	1.7	1.7	0.0
Day XIV	1.7	1.8	0.1
Day XV	1.8	2.0	0.2

Based on the table above, it is noted that during the 15-day treatment period, the nursing female rabbits given biscuits with a concentration of 15% were able to produce milk for 11 days, with a minimum milk production of 100 ml and a maximum of 200 ml.

Table 9: Normality Test Results

Data	Shapiro-Wilk		
	Statistic	df	Significance
Initial Body Weight of Control Rabbits	0.894	15	0.076
Final Body Weight of Control Rabbits	0.901	15	0.100
Initial Body Weight of Treated Rabbits	0.832	15	0.010
Final Body Weight of Treated Rabbits	0.841	15	0.013

The decision from the normality test table is used to determine the statistical tests that will be applied to address the specific objectives and hypotheses of this study. A Paired Samples Test was utilized to compare the body weight of control rabbits, while the Wilcoxon test was used for the treatment rabbits. The results of the Paired Samples Test analysis indicate that there is no significant difference (P > 0.05) in the initial and final body weight of the control nursing rabbits without the administration of winged bean seed flour biscuits. The details are presented in the following table.

Table 10: Comparison of Body Weight (Milk Volume) of Control Rabbits

Variables	df	Mean	Mean Difference	T velue	Asymp. Sig. (2-tailed)
Initial Body Weight of Control Female Rabbits	14	1,600 ± 0,1604	0,267 ± 0,1100	0,939	0,364
Final Body Weight of Control Female Rabbits	14	1,573 ± 0,1580			

The significance value in the table above indicates that the administration of biscuits without the addition of winged bean seed flour during the 15-day experiment did not result in an increase in body weight or milk volume in the nursing rabbits. Below are the results of the comparison test for the treatment rabbits that were given biscuits with the addition of winged bean seed flour.

Table 11: Comparison of Body Weight (Milk Volume) of Treatment Rabbits

Statistic Value	n	Mean	Significance	Difference
Final Body Weight of Treated Rabbits	15	1.740 ± 0.0986	0.020	0.06 kg
Initial Body Weight of Treated Rabbits	15	1.680 ± 0.0775		
Wilcoxon Test Results				
Negative Ranks	2	6.00		
Positive Ranks	10	6.60		
Ties	3			
Total	15			

Based on the table above, the significance value of 0.020 (P < 0.05) indicates a significant difference in the increase in body weight or milk volume produced during the treatment with biscuits containing winged bean seed flour. In other words, winged bean seed biscuits can enhance milk volume in nursing rabbits. The table also shows that out of 15 rabbits, 10 experienced weight gain (Positive Ranks), 2 rabbits had decreased weight (Negative Ranks), and 3 rabbits maintained their weight (Ties). Overall, the average weight gain of the nursing female rabbits was 0.06 kg, equivalent to 60 ml of milk. The increased milk production did not lead to a decrease in the nutritional content because active compounds were present that enhanced the levels of energy, protein, and fat in the milk. stated that active compounds such as 3,4-dimethyl-2-oxocyclopent-3-enulacetic acid, monomethyl succinate, phenylmalonic acid, cyclopentanol, 2-methyl-acetate, and methylpyroglutamate

undergo hydrolysis in the digestive tract, producing several metabolic products like succinate, malonic acid, acetate, and glutamate, which enter the Krebs cycle, resulting in carbohydrates, proteins, fats, and energy(Kinghorn, 1987; Rashwan & Marai, 2000b, 2000a). These metabolic products are transferred into the milk and consumed by the kits, leading to an increase in cell number (hyperplasia) and cell size (hypertrophy) in the kits' bodies.

Table 12: Weight Gain of Rabbit Kit

No.	Day 5	Day 10	Day 15	Total	Average
1	78	83	92	253	84.33
2	52	66	-	118	59
3	55	68	78	201	67
4	59	68	80	207	69

Based on the table above, the significance value of 0.020 ($P < 0.05$) indicates a significant difference in the increase in body weight or milk volume produced during the treatment with biscuits containing winged bean seed flour. In other words, winged bean seed biscuits can enhance milk volume in nursing rabbits. The table also shows that out of 15 rabbits, 10 experienced weight gain (Positive Ranks), 2 rabbits had a decrease in weight (Negative Ranks), and 3 rabbits maintained their weight (Ties). Generally, the average weight gain of the nursing female rabbits was 0.06 kg, equivalent to 60 ml of milk.

The increased milk production did not result in a reduction in the proportion of nutrients, due to the presence of active compounds that enhance the levels of energy, protein, and fat in the milk. stated that active compounds such as 3,4-dimethyl-2-oxocyclopent-3-enulacetic acid, monomethyl succinate, phenylmalonic acid, cyclopentanol, 2-methyl-acetate, and methylpyroglutamate undergo hydrolysis in the digestive tract, producing several metabolic products such as succinate, malonic acid, acetate, and glutamate, which enter the Krebs cycle, resulting in carbohydrates, proteins, fats, and energy. These metabolic products are then transferred into the milk and consumed by the kits, leading to an increase in cell number (hyperplasia) and cell size (hypertrophy) in the kits' bodies.

Table 13: Weight Gain of Rabbit Kits

No.	Day 5	Day 10	Day 15	Total	Average
1	78	83	92	253	84.33
2	52	66	-	118	59.00
3	55	68	78	201	67.00
4	59	68	80	207	69.00

The table above shows that the body weight of the rabbit kits nursing from mothers fed with winged bean seed flour biscuits increased over three measurements taken during a 15-day period. Kit number 2 could not be weighed during the third measurement because it had died. factors influencing weight gain include the type and quality of feed ingredients, feed consumption, sex, age, species, husbandry practices, and environmental conditions(*INFORMATION TO USERS*, n.d.; Moloney & McGee, 2023). The increase in weight gain of the rabbit kits may specifically be attributed to the production of the mother's milk, the weight of the mother, litter size, and kit mortality. that rabbit kits rely exclusively on maternal milk until they are 21 days old(El Nagar et al., 2014; González-Mariscal et al., 2016; Maertens et al., 2006).

The high mortality rate during this period can be caused by factors such as poor mothering ability, cannibalism by the mother, disease, and kits being too small due to insufficient milk production from the mother(Lidfors & Edström, 2024; Maertens et al., 2006; Ozawa & Gleeson, 2024). Cases observed in several rabbit farms indicate that mortality during nursing is common, resulting in only a portion of the kits surviving to weaning, which prolongs the breeding cycle. The use of minerals has long been applied in livestock management to enhance productivity in meat and milk production. The application of minerals improves metabolic processes, thereby increasing overall productivity. Below is an analysis of the trend in weight gain of rabbit kits nursing from mothers given winged bean seed flour biscuits.

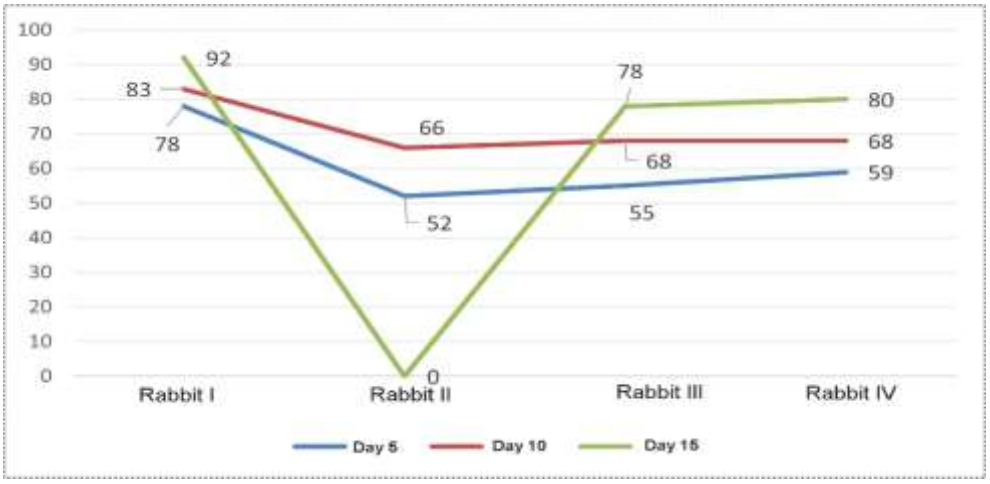

Figure 3: Trend in Weight Gain of Rabbit Kits

The figure above illustrates that, based on the measurements of the body weight of the rabbit kits nursed by their mothers at three stages (day 5, day 10, and day 15), there was a significant increase in weight at each measurement stage. This demonstrates that the mothers consuming winged bean seed flour biscuits produced an adequate amount of milk for themselves and, of course, for their kits.

4. Conclusion

The research presented in the article "Development of Biscuits from Winged Beans (Psophocarpus tetragonolobus L.) as a Primary Source for Milk Production" demonstrates that the addition of vegetable bean flour to biscuits can enhance milk production in female rabbits, with significant weight gain observed after the administration of biscuit extract. The biscuit-making process involves several formulas with varying amounts of vegetable bean flour, all producing biscuits with the same specifications but with increased proportions of the flour. Furthermore, proximate analysis reveals good nutritional content, and testing for harmful metal contamination ensures product safety. Organoleptic acceptance testing also indicates that these biscuits are well-received by consumers, highlighting their potential as a nutritious food option for breastfeeding mothers**.**

Ethical statement

This study was performed with approval from the Ethics committee of the Health Polytechnic of the Ministry of Health Aceh.

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