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The Effect of Green Bean Extract on the Nutritional Status of Toddlers

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ABSTRACT

Purpose: This study aimed to determine the effect of green bean (Vigna radiata) juice administration on the nutritional status of malnourished toddlers in Mejobo Village, Kudus District. The hypothesis proposed that daily supplementation of green bean juice would significantly improve nutritional status as measured by Z-scores.

Research Method: A pre-experimental design with a total sampling technique was applied to 32 toddlers aged 2–4 years with malnutrition (Z-score: -3 SD to < -2 SD). Respondents were divided into two groups: experimental and control. The intervention consisted of administering 250 ml of green bean juice daily for seven consecutive days. Data were collected through anthropometric measurements before and after the intervention and analyzed using the Shapiro-Wilk test, paired sample t-test, and independent sample t-test.

Results and Discussion: The mean Z-score improved from -2.431 pre-intervention to -1.77 post-intervention in the experimental group (p = 0.000), while no improvement occurred in the control group. Independent t-test results showed a significant post-test difference between groups (p = 0.000), confirming the positive effect of green bean juice on nutritional status.

Implications: Green bean juice, as a locally sourced supplementary food, is effective for short-term nutritional improvement in malnourished toddlers and can be integrated into community-based nutrition programs. Further studies with longer durations and larger sample sizes are recommended.

Keywords: malnutrition; green bean juice; nutritional status; toddler nutrition; supplementary feeding.

Introduction

The toddler years are considered the golden age, a period that has a significant influence on future growth and development. Optimal growth and development in children are supported by the nutrients they consume. The nutrients consumed by toddlers must meet all the nutrients needed by the body, including macronutrients such as carbohydrates, proteins, and fats, as well as micronutrients, namely vitamins and minerals. If one or more nutrients are not met, this can lead to nutritional problems in children, one of which is malnutrition (Siringoringo *et al.*, 2020). Malnutrition can lead to physical growth failure, reduced immune system function, making children more susceptible to diseases, and impaired cognitive and intellectual development. More severe consequences of malnutrition include disabilities and even death. Nutritional problems are caused by direct and indirect factors (J *et al.*, 2022).

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The direct causes of malnutrition are insufficient food intake and infectious diseases. Unbalanced nutrition can impact the immune system's functioning, thereby increasing the risk of infection. Conversely, the body requires more energy to recover from illness. Indirect causes include inadequate childcare, insufficient food supplies, and inadequate basic health services and environments (Adelina *et al.,* 2019). According to a study conducted by Helmi, (2018), 68.75% of infants suffer from malnutrition caused by infectious diseases, and 51.78% of infants suffer from malnutrition caused by protein deficiency. From the bivariate analysis, the p-value was 0.000 for contagious diseases and 0.003 for protein intake deficiency, with a 95% confidence interval (CI), indicating a significant association between infectious diseases and protein intake deficiency, as well as the occurrence of malnutrition in infants. Meanwhile, according to a study conducted by Alamsyah *et al.,* (2015) in 2015 in Pontianak, malnutrition in infants is influenced by parenting patterns and environmental sanitation. This was indicated by the results of bivariate analysis, which yielded p-values of 0.001 and 0.004 with 95% CI, and it can be concluded that there is a relationship between parenting patterns and environmental sanitation with the occurrence of malnutrition in infants.

According to the Ministry of Health of the Republic of Indonesia (2021) and Ummi Kulsum et al. (2023), Central Java Province reported 3.7% of cases of severe malnutrition among infants and 13.68% of cases of moderate malnutrition among infants. Based on district/city health profile data, the prevalence of underweight infants was 5.4% of cases, severely stunted infants accounted for 31.15% of cases, malnourished infants made up 2.69% of cases, and short infants constituted 20.06% of cases in 2019. Kudus District recorded 3.6% of cases of undernourished infants, 4.7% of cases of short infants, and 2.9% of cases of underweight infants. There were 2,871 cases (4.7%) of stunted infants in the working area of the Kudus District Health Center. Malnutrition can be overcome by providing nutritious food. One such intervention is the provision of supplementary food (PMT). Supplementary food can be obtained from locally processed foods. In addition to promoting local food production, this is also because local foods are more easily accessible, such as eggs, fish, and legumes, particularly green beans (Muafa *et al.,* 2024). Green beans (Vigna Radiata) are an alternative source of plant-based protein, vitamins (A, B1, C, and E), and fiber. Green beans also contain other nutrients beneficial to the body, such as iron, calcium, sulfur, and niacin. Green beans are one of the legumes that offer numerous benefits for the body. These include boosting the immune system, promoting bone health, aiding weight gain, enhancing fertility, improving digestion, and supporting brain health. Green beans are one of the foods with the third-highest protein content after soybeans and peanuts. The high protein content in green beans is beneficial for the formation of new body cells, thereby influencing growth. Infant growth can be observed and monitored, one of which is through body weight. Body weight reflects the amount of protein, fat, water, and minerals in the body and also indicates physical growth and nutritional status (Anugrahtama *et al.,* 2020).

Green beans are also low in fat, so green bean products do not have a rancid smell and are suitable for people who avoid foods high in fat. Additionally, green beans are rich in vitamin B1. Vitamin B1 acts as a coenzyme that aids in metabolic processes within the body, thereby facilitating the production of energy. A deficiency in vitamin B1 can lead to a loss of appetite, which may result in weight loss (Fitriani & Taryono, 2022). Besides containing nutrients beneficial to the body, green beans also offer several advantages, including being easy to consume, process, and access, as well as being familiar to the public. Green beans can be processed into porridge, used in beverages like green bean juice, or used as vegetables like bean sprouts. Additionally, green beans can be processed into biscuits, crackers, and fillings for onde-onde and bakpau (Pertiwi, 2018).

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Literature Review and Hypothesis Development

Malnutrition

Malnutrition is a condition in which the body does not get enough macro and micronutrients needed for optimal growth and development. According to the World Health Organization (WHO, 2020), malnutrition encompasses energy, protein, and micronutrient deficiencies that can lead to growth, development, and health issues in children. The Indonesian Ministry of Health (2021) also defines malnutrition as a nutritional status below the standard based on weight-for-age (WFA) indicators with Z-scores ranging from -3 SD to less than -2 SD. Malnutrition can have both short-term and long-term effects. Short-term effects include stunted growth, impaired brain development, metabolic disorders, and weakened immune systems, increasing the risk of infectious diseases such as diarrhea and respiratory infections. Long-term effects of malnutrition include reduced intelligence, poor academic performance, and increased risk of disabilities and mortality in children (Ramadhia *et al.,* 2021). Additionally, malnutrition occurring during the golden period (ages 0–3 years) can permanently impair brain structure and function. Therefore, prevention and management of malnutrition must be comprehensive and sustained.

Causes of Malnutrition

Several interrelated factors contribute to malnutrition in toddlers. According to UNICEF (1990), the causes of malnutrition can be categorized into direct and indirect causes. Direct causes include inadequate nutritional intake and infectious diseases. Poor dietary intake, in terms of both quantity and quality, prevents children from obtaining sufficient nutrients for optimal growth. Additionally, infectious diseases such as diarrhea, acute respiratory infections (ARI), and parasitic infections can impair nutrient absorption and increase the body's energy requirements, ultimately worsening the child's nutritional status (Adelina *et al.,* 2019). Indirect causes of malnutrition include inadequate childcare practices, limited access to nutritious food, unhealthy environments, and insufficient healthcare services. A dirty environment, poor sanitation, and restricted access to basic health services such as immunization and child growth monitoring are important factors that exacerbate malnutrition. Additionally, social, economic, and cultural factors such as poverty, low parental education levels, and unhealthy eating habits also influence the occurrence of malnutrition in infants (Alamsyah *et al.,* 2015).

Factors Causing Malnutrition

The factors causing malnutrition in toddlers are complex and interrelated. One of the primary factors is the low level of education among parents, especially mothers, which leads to a lack of understanding about the importance of balanced nutrition and age-appropriate diets. Low family income also affects a family's ability to provide their children with quality food. Inappropriate eating patterns, such as feeding children a diet that is not varied and does not meet their energy and protein needs, exacerbate the risk of malnutrition. An unhealthy environment, lack of access to clean water, and poor sanitation increase the risk of infections that can interfere with nutrient absorption and uptake. In addition, cultural and dietary practices, such as food restrictions for children, also contribute to malnutrition. Limited access to health services, including immunization, regular weight monitoring, and nutrition education, makes it difficult to detect and address malnutrition early on. These factors create a cycle of problems that persists if not addressed comprehensively and promptly.

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How to Measure Nutritional Status

Nutritional status in infants can be assessed using various methods, one of which is anthropometric measurement, a common approach in public health services. According to the Indonesian Ministry of Health (2020), indicators commonly used to assess the nutritional status of infants include weight for age (WFA), height for age (HFA), and weight for height (WFH). Weight-for-age is used to identify infants with malnutrition or overnutrition, while height-for-age is used to detect stunting. Weight-for-height is used to assess wasting, a condition where infants are thin due to acute malnutrition. Nutritional status assessment based on Z-scores refers to WHO standards, where infants with Z-scores below -2 SD are categorized as malnourished. In addition to anthropometric measurements, nutritional status can also be assessed through clinical examinations and evaluation of children's daily food intake. Regular nutritional status assessments are crucial for monitoring infant growth and serve as an early step in detecting and addressing nutritional issues promptly.

Malnutrition Management

Malnutrition in toddlers must be addressed in an integrated manner involving various sectors. According to the Indonesian Ministry of Health (2021), malnutrition management is divided into specific interventions and sensitive interventions. Specific interventions include supplementary feeding (PMT), supplementation of essential nutrients such as vitamin A and iron, and provision of high-energy and protein-rich foods that children can easily digest. One example of an effective specific intervention is the provision of supplementary foods based on local foods such as green bean porridge. Additionally, educating parents about the importance of balanced nutrition and healthy eating habits is also essential. Sensitive interventions include environmental improvements, provision of clean water, improved sanitation, and increased access to basic health services such as immunization and regular growth monitoring. Programs such as nutrition counseling at health posts and raising community awareness about the importance of monitoring children's growth and development are also essential components of efforts to address malnutrition. Effective management requires collaboration among the health, education, and social sectors to ensure the sustainability of improving the nutritional status of infants and young children.

Definition of Green Beans

Green beans (Vigna radiata L.) are a type of legume widely cultivated by farmers in Indonesia. This plant is an essential commodity because it produces food rich in protein, fiber, vitamins, and minerals. Green beans contain multiple proteins that function to replace damaged body cells and support growth, making them a recommended food for children and postpartum women. Additionally, green beans contain unsaturated fats beneficial for heart health and vitamin B1, which helps improve appetite and aid metabolic processes in the body. Green beans are easily processed into various food forms, such as porridge, beverages, and cake fillings, making their use practical and well-accepted in society (Donsu *et al.,* 2021).

The Effect of Green Bean Intake on Nutritional Status

Green beans play a crucial role in enhancing nutritional status, particularly in children who are malnourished. The protein, carbohydrate, fiber, vitamin, and mineral content in green beans has been proven effective in increasing weight and improving the nutritional status of toddlers. Regular

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consumption of green bean porridge can help meet children's daily energy and nutritional needs. Research shows that regular consumption of green bean porridge for 30 days can significantly increase the weight of infants and improve their nutritional status. Additionally, green beans contain unsaturated fatty acids beneficial for health, as well as vitamin B1 and vitamin C, which support increased appetite and iron absorption. Processing green beans into porridge or green bean extract, which is easily digestible by infants, is one of the simple yet effective interventions to address malnutrition in children (Arisanti *et al.,* 2023a; Nadya Witri, 2020).

Research Method

This study employs an experimental research design, which involves providing an intervention or treatment to observe its effects. This study has several types of divisions. In this case, the researcher took a pre-experimental study with the variable used as the intervention being green bean juice. The subjects were toddlers in the village of Mejobo, Kudus district. The sample used in this study consists of toddlers with poor nutrition residing in Mejobo Village, Kudus District. The researcher obtained a sample size of 32 respondents from Mejobo Village, Kudus District. All toddler samples were selected using the Total Sampling technique. This was also considered based on the characteristics of the population, with inclusion and exclusion criteria established. The chosen samples met the inclusion and exclusion criteria established by the researcher. The inclusion criteria in this study were:

- underweight Infants (Z-score: -3SD to 2S)
- Toddlers aged 2-4 years.
- Toddlers with parents who were willing to have their children participate in the study were confirmed by obtaining informed consent.

A sample is a subset of a population that has representative characteristics and is large enough to be considered representative of the population as a whole. The sampling method used in this study is purposive sampling.

Results and Discussion

Analysis Result

Respondent characteristics

Table 1. Respondent Characteristics

Gender of respondents	**f**	**%**
Man	12	37,5
Woman	20	62,5
Age	**f**	**%**
2 Year	9	28,1%
3 Year	9	28,1%
4 Year	12	37,5%
5 Year	1	3,1%
Total	32	100%

Based on Table 1, it can be seen that out of 32 respondents, the majority were female, comprising 20 respondents (62.5%), while the male respondents numbered 12 (37.5%). The majority of children were in the 4-year-old age group, namely 12 children (37.5%). Furthermore, the number of

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children aged 2 and 3 years old was nine children (28.1%) each. Meanwhile, there was only one child (3.1%) aged 5 years old. This distribution shows that most respondents in the study were of preschool age, with a predominance of 4-year-olds.

This is important to note because at this age, children's growth and development are still highly dynamic, and responses to nutritional interventions (such as green bean juice supplementation) can be more clearly observed physiologically. Children's age can also influence appetite, physical activity, and metabolism, making it an essential variable in studies related to nutritional status and weight gain.

Univariate analysis

Table 2. Green bean feeding data

Categories of Green Bean Juice Administration	f Experiment	% Experiment
Every day for 7 days (adhering to the regimen)	16	100,00%
Not every day for 7 days (non-compliant)	0	0,00%
Total	**16**	**100,00%**

Source: Primary Data Processing, 2025

Based on Table 2, all respondents in the experimental group (100.00%) were classified as compliant, meaning they received green bean extract every day for seven consecutive days. There were no respondents classified as non-compliant.

These results indicate that the intervention, which involved the administration of green bean extract, was successfully implemented consistently without any obstacles during the intervention period. The 100% compliance rate reflects the effectiveness of intervention implementation, control, and active participation from both the families and the respondents. This is important to ensure the validity of the intervention's impact on changes in the nutritional status or body weight of the respondents under study.

Nutritional status measurement data

Table 3. Nutritional status of toddlers before administration of mung bean extract

Before intervention	n	Mean	Median	Min	Max	Standard Deviation
Weight Before	16	11,68%	11,80%	9,80%	14,40%	1,35%

Source: Primary Data Processing, 2025

Based on Table 3, it is evident that all respondents in both the experimental and control groups fell into the malnourished category, with 16 children (100%) in each group. There were no respondents with good nutritional status in either group. This uniform distribution indicates that the initial dietary status of both groups was comparable, meaning there was no difference in nutritional status between the experimental and control groups before the intervention. This equality is essential to ensure the internal validity of the study, as the effects of the intervention can be assessed more objectively without

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the influence of different initial conditions. Thus, any changes in nutritional status after the intervention can be more closely associated with the treatment provided, such as the administration of green bean extract or other control treatments.

Based on Table 4, a significant change in nutritional status was observed in the experimental group after seven days of administering green bean extract. All respondents in the experimental group (100%) demonstrated an improvement in nutritional status, transitioning from the malnourished category to the well-nourished category. Conversely, in the control group, all respondents (100%) remained in the underweight category, with no change in nutritional status. These results suggest that administering green bean juice may have a positive impact on children's nutritional status. The consumption of green bean juice, which is rich in plant-based protein, energy, and micronutrients, is suspected to play a role in weight gain and improvements in nutritional status indices. The absence of changes in the control group strengthens the hypothesis that the improvement in nutritional status in the experimental group is directly related to the intervention provided.

Table 4. Nutritional status of toddlers after administration of mung bean extract

After intervention	n	Mean	Median	Min	Max	Standard Deviation
Weight After	16	14,48%	14,30%	12,30%	17,80%	1,53%

Source: Primary Data Processing, 2025

Normality test

A normality test is conducted to determine whether the data is normally distributed or not. This test is a prerequisite for selecting the type of statistical test to be used in further analysis. If the data is usually distributed, parametric tests such as the t-test can be used. Conversely, if the data is not normally distributed, non-parametric tests are used. In this study, the normality test was performed using the Shapiro-Wilk test, as the sample size of 32 respondents is below the 50-sample threshold, according to the recommended use of the Shapiro-Wilk test.

Table 6. Shapiro Wilk Normality Test Results

Group	Statistik Shapiro-Wilk	df	Sig.	Conclusion
Green beans	0,997	32	1.000	Normal
Nutritional status	0,935	32	0,055	Normal

Source: Primary Data Processing, 2025

Based on the results in Table 5, it can be seen that the normality test using the Shapiro-Wilk test indicates that the data in the green bean group has a significance value of 1.000, with a Shapiro-Wilk statistic of 0.997 and a sample size (df) of 32. Because the significance value is greater than 0.05, the data in the green bean group is usually distributed. Meanwhile, in the nutritional status group, the significance value was 0.055 with a statistic of 0.935, and the same sample size of 32. Although the significance value is close to 0.05, it is still above the threshold, so the data is also considered to be normally distributed. Thus, both data groups meet the normality assumption and can be further analyzed using parametric statistical tests.

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Paired Sample t-Test

The paired sample t-test is used to determine the difference between two paired measurements within the same group, specifically comparing pre-test and post-test values within a single group. In this study, the test was conducted to determine whether there was a significant difference in the nutritional status of toddlers before and after the intervention.

Table 6. Results of Paired Sample T-Test

Data Pair	Mean Difference	Std. Deviation	Std. Error Mean	t	df	Sig. (2-tailed)
Pre-test – Post-test	0,65	0,49	0,87	7,53	31	0,00

Source: Primary Data Processing, 2025

Based on Table 6, it is known that the mean difference between the pre-test and post-test values is 0.65, indicating an improvement in nutritional status after the intervention. The calculated t-value is 7.53 with df = 31, and the significance value (Sig. 2-tailed) is 0.001. Since the significance value is less than 0.05 ($p < 0.05$), it can be concluded that there is a statistically significant difference in nutritional status before and after the intervention.

Independent Sample T-Test

The independent sample t-test is used to determine whether there is a significant difference between two unrelated groups, specifically the experimental group and the control group. In this study, the test was conducted on the pre-test and post-test results of the waist circumference of postpartum mothers in both groups.

Table 7. Results of the Independent Sample T-Test

Time	t	df	Sig. (2-tailed)	Mean Difference	Description
Pre-Test	0,402	30	0,691	-0,206	Not Significant
Post-Test	-9,708	30	0,000	-0,817	Significant

Source: Primary Data Processing, 2025

Explanation of Results:

Pre-test:

The test results indicate that there was no significant difference between the control group and the experimental group before the intervention. The significance value (p-value) was 0.691 > 0.05, so H_0 was accepted. The t-value of 0.402 and the mean difference of -0.206 indicate that the initial conditions of both groups were relatively equivalent, meaning there were no notable differences in nutritional status before the intervention being administered.

Post-test:

Following the intervention, the test results revealed a significant difference between the control and experimental groups. The significance level was 0.000 < 0.05, with a t-value of -9.708 and a mean difference of -0.817, indicating that the experimental group experienced a greater improvement in

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nutritional status compared to the control group. Therefore, H_1 was accepted, meaning that there was a significant effect of green bean extract supplementation on changes in the nutritional status of the respondents.

Discussion

Respondent Characteristics

The characteristics of the respondents in this study include two variables: gender and age of the toddlers. Most of the respondents were female, with 20 children (62.5%), while males accounted for 12 children (37.5%). These results indicate that although there were more female toddlers among the respondents, the gender distribution remained proportionally balanced. Looking at the age distribution, most respondents were 4 years old (37.5%), followed by 2 and 3 years old, each accounting for 28.1%, and only one child (3.1%) was 5 years old. The 2–5-year-old age group is a period of active growth that requires optimal nutrient intake, making nutritional interventions in this age group highly relevant.

Univariate Analysis

Nutritional Status Before and After Administration of Green Bean Extract

The nutritional status of infants before receiving intervention in the form of green bean extract showed that all respondents were still in the malnourished category, with an average Z-score of -2.431 and a standard deviation of 0.1432. The minimum Z-score was -2.74, and the maximum was -2.12. The narrow range of values and consistent Z-scores indicate that the majority of infants were moderately malnourished, which is in line with the WHO indicator of a Z-score between -3 SD and < -2 SD (Indonesian Ministry of Health, 2021, in Kulsum *et al.,* 2023). This low nutritional status may reflect the possible presence of contributing factors, such as low protein intake, recurrent infections, and a lack of understanding of infant feeding patterns within the family. This aligns with Helmi's (2023) findings, which indicate that the primary causes of malnutrition in infants are related to infections and protein deficiency. Additionally, Alamsyah et al. (2015) also emphasized that inadequate childcare practices and poor environmental sanitation further exacerbate the nutritional status of infants. Therefore, before the intervention, the nutritional status of the respondents was relatively homogeneous, indicating a need for rapid, easily digestible, and infant-acceptable dietary interventions.

Nutritional Status After Administration of Green Bean Extract

After receiving an intervention in the form of 250 ml of green bean extract per day for 7 days, there was an improvement in the nutritional status of infants. The average Z-score increased to -1.77, with a minimum value of -2.44 and a maximum of -0.90, and the standard deviation increased to 0.476. This indicates a shift toward a nutritional status closer to the standard category, although not all children have reached the Z-score threshold above -2 SD. This increase in Z-score reflects significant improvements in nutritional status and weight gain. Statistical tests support this, with the paired sample t-test yielding a significance value of 0.000 ($p < 0.05$). This indicates a significant difference between the pre-intervention and post-intervention periods. These results are supported by previous studies, such as those by Arisanti et al. (2023) and Witri (2020), which have shown that providing green beans in the form of porridge or juice can significantly increase the weight of toddlers. The nutritional content of green beans—such as protein, vitamin B1, iron, and fiber—plays a significant role in supporting cell

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growth, increasing appetite, and improving body metabolism (Anugrahtama *et al.,* 2020; Fitriani & Taryono, 2022).

Normality Test

Based on the results of the normality test using the Shapiro-Wilk method, it was found that the significance values for the nutritional status data before and after treatment were 1.000 and 0.055, respectively. Since the p-value is greater than 0.05, it can be concluded that the data are normally distributed and therefore suitable for analysis using parametric tests, such as the paired sample t-test and independent sample t-test. This normal distribution is essential to ensure the validity of statistical test results, as parametric tests are only appropriate when data meet the assumption of normality (Ministry of Health of the Republic of Indonesia, 2020). The Shapiro-Wilk test is also recommended for small sample sizes (<50), making it an appropriate and suitable choice for the number of respondents, which is 32 infants.

Paired Sample T-Test

This test was conducted to determine whether there was a significant difference in the nutritional status of toddlers before and after intervention in the same group (paired). The test results showed that: Mean Difference: 0.65 t-value: 7.53 p-value (Sig. 2-tailed): 0.000 Since $p < 0.05$, it can be concluded that there is a significant difference between the nutritional status before and after the intervention, meaning that the administration of green bean extract has a significant effect on improving the nutritional status of infants. These results are consistent with those of Arisanti et al. (2023) and Witri (2020), which indicate that green beans are effective in improving nutritional status due to their complete nutritional content, including protein, vitamin B1, iron, and fiber. Vitamin B1 plays a role in increasing appetite, while protein aids in tissue growth and repair. The administration of green bean extract as an intervention is highly effective due to its advantages as a high-protein plant-based source, low in saturated fat, and rich in essential micronutrients such as iron, calcium, magnesium, and vitamins B1 and B2 (Fitriani & Taryono, 2022). The vitamin B1 content in green beans can stimulate appetite and enhance energy metabolism, leading to increased body weight.

Independent Sample T-Test

This test was used to determine the difference in nutritional status between the experimental group and the control group, which were not paired. The test results showed: Pre-test: $p = 0.691$ (not significant); Post-test: $p = 0.000$ (significant). In the pre-test, there was no significant difference between the two groups, indicating that the initial conditions of the control and experimental groups were equivalent. However, in the post-test, a significant difference was observed, with the experimental group (which received green bean extract) showing a significantly better improvement in nutritional status. The p-value of 0.000, with $t = -9.708$, indicates that the intervention of green bean extract administration plays a significant role in improving nutritional status. In contrast, the control group did not show meaningful changes. This difference indicates that the improvement effect was not caused by external factors but by the treatment itself. These findings are supported by Muafa et al. (2024), who stated that locally based supplementary feeding programs, such as those incorporating green beans, can have a significant impact on improving children's nutritional status. These findings reinforce the results of Witri's (2020) study, which found that infants who were regularly given supplementary food in the form

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of green bean porridge experienced significant weight gain within one month. These results align with the research by Arisanti et al. (2023) and Witri (2020), which stated that green beans are effective in improving nutritional status due to their complete nutritional content, including protein, vitamin B1, iron, and fiber. Vitamin B1 plays a role in increasing appetite, while protein aids in the growth of body tissue.

Comparison Before and After Intervention

When comparing the results before and after treatment, the following occurred: an increase in the average Z-score from -2.431 to -1.77, indicating that some of the toddlers were no longer classified as malnourished. An increase in standard deviation indicates variation in response to the intervention, which may be influenced by other factors such as daily diet, general health, and each child's absorption capacity. The results of the paired sample t-test yielded a t-value of 7.53 and a p-value of 0.000, indicating that the intervention had a statistically significant effect on changes in nutritional status. This study demonstrates that simple, locally based food interventions, such as green beans, can have a positive impact in a short period. This also reinforces the recommendations of Muafa et al. (2024) that locally based supplementary foods are highly relevant and effective for improving the nutritional status of infants in communities with limited resources.

Conclusion

The nutritional status of infants before intervention, in the form of green bean juice administration, was, on average, in the malnutrition category (average Z-score: -2.431). Following the intervention, a significant improvement in nutritional status was observed, with the average Z-score decreasing to -1.77. The administration of green bean extract over 7 days had a substantial impact on improving the nutritional status of malnourished infants in Mejobo Village. This was demonstrated by the results of the Paired Sample T-Test and Independent Sample T-Test, which showed a significance level of < 0.05.

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