Indonesian Journal of Global Health Research
Volume 6 Number 5, October 2024
e-ISSN 2715-1972; p-ISSN 2714-9749
http://jurnal.globalhealthsciencegroup.com/index.php/IJGHR

THE EFFECT OF MORINGA LEAF PROCESSING ON HEMOGLOBIN LEVELS IN STUNTED TODDLERS

Marthina Sahureka[1*], Munaya Fauziah[2],Titin Sutini[1], Nyimas Heny Purwati[1], Nuraidah[1]
[1]Faculty of Nursing, Universitas Muhammadiyah Jakarta, Jl. K.H. Ahmad Dahlan, Cireundeu, Ciputat Timur, Tangerang Selatan, Banten 15419, Indonesia
[2]Faculty of Public Health, Universitas Muhammadiyah Jakarta, Jl. K.H. Ahmad Dahlan, Cireundeu, Ciputat Timur, Tangerang Selatan, Banten 15419 Indonesia
*inesahureka@gamil.com

ABSTRACT
Children facing prolonged malnutrition are susceptible to stunting, a condition marked by insufficient hemoglobin levels crucial for oxygen and nutrient transportation in the bloodstream. Addressing this issue involves dietary interventions rich in protein and iron, such as processed Moringa leaves. This study aims to identify the effect of giving processed Moringa leaves on increasing hemoglobin levels in stunted toddlers in the Tawiri Community Health Center working area, Ambon City. This research method is a quasi-experimental two-group pretest-posttest design with control group with a sample of 22 toddlers in each group. The data in this study were collected using the Morisky Medication Adherence Scale-8 (MMAS), a measurement tool for medication adherence in patients with chronic diseases, consisting of 8 questionnaire items. The classification of the results is as follows: a score of <6 indicates low adherence, 6-7 indicates medium adherence, and 8 indicates high adherence. The research results showed that the average hemoglobin level in the intervention group before and after administering processed Moringa leaves was 10.20-11.34 (difference: 1.14 g/dl), while in the control group it was 10.42 g/dl-10.45 g/dl (difference: 0.03 g/ dl). Based on the results of the analysis, it was found that the p-value was 0.001, which meant that there was a difference in the increase in hemoglobin levels of stunted toddlers in the intervention group and the control group. In the multivariate analysis of the confounding variables (age, gender, nutritional adequacy, and physical activity) that influenced hemoglobin levels were comorbidities with a p-value of 0.012. The results of this research can be used as a basis for parents to give processed Moringa leaves to stunting toddlers as an effort to increase hemoglobin levels.

Keywords: hemoglobin; moringa leaves; stunting; toddler

First Received	Revised	Accepted
22 April 2024	28 April 2024	30 April 2024

Final Proof Received	Published
27 May 2024	01 October 2024

How to cite (in APA style)
Sahureka, M., Fauziah, M., Sutini, T., Purwati, N. H., & Nuraidah, N. (2024). The Effect of Moringa Leaf Processing on Hemoglobin Levels in Stunted Toddlers. Indonesian Journal of Global Health Research, 6(5), 2497-2506. https://doi.org/10.37287/ijghr.v6i5.3482.

INTRODUCTION

Malnutrition places children at a higher risk of death due to increased susceptibility to infections, the severity of which can delay recovery. This combination of malnutrition and infection creates a cycle that significantly heightens the risk of mortality. If malnutrition occurs during the golden age of development, it can hinder growth and cognitive development, leading to reduced physical activity and intelligence (Unicef, 2023) Children suffering from chronic malnutrition are at risk of stunting. In 2020, the global number of stunted children under the age of five was 149.2 million. Although UNICEF reports that the prevalence of stunting has decreased since 2000, Africa and Asia still had the highest prevalence of stunting in that year, while Europe, Central Asia, and North America had the lowest. According to the latest data from the World Bank, WHO, and UNICEF in 2023, 22%

of children under the age of five, or 1 in 5 children, are stunted. The global prevalence of stunting decreased from 33.1% to 22% between 2000 and 2020, but it has increased in subsequent years.

The government, through the Ministry of Health, has launched 11 specific interventions for stunting focused on pregnancy and children aged 6-23 months. These include anemia screening, exclusive breastfeeding, growth monitoring for toddlers, providing nutritious complementary foods, iron supplementation for adolescent girls and pregnant women, and pregnancy check-ups (Kemenkes RI, 2022) The government's nutrition prevention and management program is implemented through community health centers (puskesmas). Based on the government's program, the Tawiri Community Health Center should conduct activities ranging from screening to the comprehensive management of nutritional diseases (including stunting and anemia) if these conditions are found in toddlers. Data from the Tawiri Community Health Center shows that screening programs are in place, but comprehensive management has not yet been implemented. Anemia screening at the Tawiri Community Health Center is mainly oriented towards surveillance of nutritional issues through posyandu with weight and height measurements (Puskesmas Tawiri, 2023).

Anemia screening is the primary focus of stunting intervention because anemia is closely related to the occurrence of stunting in children and pregnant women (Hastuty, 2020; Iftikhar, 2018; Salma & Alifariki, 2021). Nurmalasari et al., (2020)reveal a relationship between stunting and hemoglobin levels in children. Additionally, the Faculty of Medicine at the University of Indonesia (2023) explains that the most common cause of anemia in children is iron deficiency, which can be a significant factor in the occurrence of stunting. Iron is one of the essential elements for optimizing the first 1,000 days of life, including the prevention of stunting. Agustin (2022) explains that one cause of low hemoglobin is iron deficiency. Dewi & Nindya (2017) state that iron deficiency can disrupt linear growth. Iron is a crucial nutrient for the growth and development of children as it is necessary for tissue formation. Moreover, iron plays a role in increasing Insulin-like Growth Factor (IGF), particularly in bone growth acceleration(Nasution et al., 2014). Nasution et al., (2019) state that pregnant women with iron deficiency anemia may experience reduced IGF concentrations, disrupting nutrient transport from mother to fetus, ultimately affecting fetal growth(Fuada et al., 2019).

Iron can be easily found in nature from both animal and plant sources(Ningtyas et al., 2018) . Susilonningtyas further explains that animal-based iron is found in meat, eggs, liver, and offal, as well as in shellfish (Abdullah & Haumahu, 2020). Plant-based iron is found in spinach(Kurniawati & Fitriyya, 2018; Sinaga et al., 2021; Sumarni & Syarif, 2020), broccoli, and legumes (Fuadah & Rahayu, 2018; Widiwurjani et al., 2019) Moringa leaves are abundant and easily grown in Indonesia Winarno (2018) and are endemic to Maluku, including Ambon (Universitas Pattimura, 2021). Moringa leaves have been consumed as food for a long time (Akbar et al., 2019). In addition to their other advantages, Moringa leaves have been proven to increase hemoglobin levels (Khofifah & Mardiana, 2023b; Manggul et al., 2021; ShinJa et al., 2019). ShinJa et al., (2019)found that Moringa oleifera leaf powder supplementation reduces anemia in children under two years old. Ponka et al., (2022) showed that combining soy milk with Moringa leaves significantly increases fat, fiber, protein, copper, manganese, and iron content, ultimately raising hemoglobin levels in children. Therefore, Moringa leaf interventions can increase hemoglobin levels in children (Meikawati et al., 2021; Ponka et al., 2022)

Given the evidence-based benefits of Moringa leaves for increasing iron levels in children, these leaves have been processed into various food forms such as biscuits (Manggul et al., 2021). Based on the background described above, including the incidence of stunting and the endemic nature of Moringa in Ambon, and the evidence that consuming Moringa leaves can increase hemoglobin levels in stunted toddlers due to their iron and protein content, this research aims to demonstrate how Moringa leaf consumption affects hemoglobin levels in stunted toddlers in the working area of the Tawiri Community Health Center in Ambon.

METHOD

This study employs a pre-experimental design. The research design is a two-group pretest-posttest design with a control group. The study population consists of all stunted toddlers in the Tawiri Community Health Center area in Ambon City, totaling 82 toddlers. The sampling technique used in this study is cluster random sampling, resulting in 44 samples: 24 from Laha Village, 9 from Tawiri Village, and 11 from Hatiwe Besar Village. The data in this study were collected using the Morisky Medication Adherence Scale-8 (MMAS-8) questionnaire, which is a measurement tool used to assess the level of medication adherence in patients with chronic diseases and consists of 8 items. The classification of MMAS-8 measurement results is as follows: a score of less than 6 indicates low adherence, a score of 6-7 indicates medium adherence, and a score of 8 indicates high adherence. The results of this study were analyzed using two methods. A paired t-test was conducted with a significance level of 0.05 (α=0.05). Additionally, an independent sample t-test was performed to examine the difference in scores between the control and intervention groups. Further analysis was conducted using multivariate analysis with multiple linear regression. This research has undergone an Ethical Clearance (EC) review and has received ethical approval with the number 1204/F.9-UMJ/VIIII/2023.

RESULTS

Characteristics of Respondents

Data on the characteristics of respondents based on the age of stunted toddlers can be seen in the table below:

Table 1.
Average Age of Stunted Toddlers (n=44)

Variable	Mean	SD	Min-Max
Age	31,63	21,45	10-55,2

Table 1 above shows that the average age of stunted toddlers is 31.36 months with a standard deviation of 12.45 months. The ages of the stunted toddlers range from 10 to 55.2 months

Table 2.
Analysis of Hemoglobin Levels Before and After Moringa Leaf Processing in the Control and Intervention Groups for Stunted Toddlers (n=44)

Variable	Mean	SD	Min-Max (CI 95%)
HB Conrol Group			
Prettest	10,42 g/dl	0,76	8,4-11,7 g/dl
Posttest	10,45 g/dl	0,77	8,2-11,8 g/dl
Range		0,03 g/dl	
Hb Intervention Group			
Prettest	10,20 g/dl	1,00	8-12 g/dl
Posttest	11,34 g/dl	0,83	9,8-13 g/dl
Range		1,14 g/d/	

Table 2 shows that in the control group, the mean hemoglobin (Hb) level was 10.42 g/dL, while the final Hb level was 10.45 g/dL. The difference between the initial and final Hb measurements in the control group was 0.03 g/dL. In contrast, the intervention group, which received Moringa leaf porridge and vegetable intervention, exhibited a mean difference of 1.14 g/dL. Specifically, the mean hemoglobin level before the Moringa leaf intervention was 10.2 g/dL, and after the intervention, it was 11.34 g/dL.

Bivariate Analysis

Analysis of the Difference in Hemoglobin (Hb) Before and After in the Control and Intervention Groups To test the difference in Hb before and after in both groups, a paired t-test was used. The test results are as follows:

Table 3.
Difference in Hemoglobin Levels Before and After in Stunted Toddlers in the Control and Intervention Groups (n=44)

Group	Mean	SD	95%CI	*p-value*
Control				
Pre	10.42	0.76	-1.59 – (-0.66)	0.438
Post	10.45	0.77		
Intervention				
Pre	10.20	1.00	- 0.11 – 0.05	0.000
Post	11.34	0.82		

Based on the analysis of the difference in the mean Hb levels of the intervention group before and after the intervention using the paired t-test, a p-value smaller than α = 0.05 (p<0.05) was obtained, namely 0.000. Therefore, it can be concluded from this test that there is a significant difference in the mean Hb levels before and after the intervention in the intervention group. The mean Hb level after (11.34) is higher than the mean Hb level before (10.20). Based on the analysis of the difference in the initial and final Hb levels in the control group using the paired t-test, a p-value greater than α = 0.05 (p<0.05) was obtained, namely 0.438. Therefore, from the analysis results, it can be concluded that there is no significant difference in the mean initial and final Hb levels in the control group. The mean initial Hb value (10.45) is not significantly different from the mean final Hb value (10.42).

Differences in the mean hemoglobin levels between the control and intervention groups

The results of the analysis of the difference in the mean hemoglobin levels between the control and intervention groups using an independent sample t-test can be seen in the table below:

Table 4.
Difference in hemoglobin levels between the control and intervention groups (n=44)

Variable	Group	SE	*p-value*
Hemoglobin Postest	Control	0.1662	0.001
	Intervention	0.1767	

Table 4, it is shown that the difference in Hb levels after intervention in the intervention group, with a standard deviation of 0.82897, contributes to the increase in hemoglobin levels in stunted toddlers. Meanwhile, the standard deviation for the increase in hemoglobin levels in stunted toddlers is 0.77996. The analysis results indicate a p-value of 0.001 (p<0.05). Therefore, from this test, it can be concluded that there is a significant difference in the mean Hb levels after intervention between the control and intervention groups in stunted toddlers.

Multivariate Analysis

After conducting bivariate analysis, multivariate analysis was performed to determine the influence of confounding variables (age, gender, nutritional adequacy, physical activity, and comorbidities) on the hemoglobin levels of stunted toddlers.

Table 5.
Results of the analysis of the influence of confounding variables on the increase in Hb levels of stunted toddlers (n=44)

Variable	R^2	*P Value Anova*	*Cosfficients B*	*P Value*
Age	0,193	0,012	0,116	0,46
Comorbidities			0,374	0,02

DISCUSSION

Hemoglobin Levels in Stunted Toddlers Before and After Moringa Leaf Intervention

Based on the t-test results, the significance value of the effect of Moringa leaves on the hemoglobin levels of stunted toddlers is $p<0.05$, specifically 0.000. This indicates a significant difference in hemoglobin levels before and after the intervention, demonstrating that the intervention effectively increased hemoglobin levels. In the intervention group, the average increase in Hb levels was 1.14 mg/dL. This finding is supported by similar studies showing increased hemoglobin levels due to Moringa leaf consumption (Pratiwi & Nurjanna, 2019;Manggul et al., 2021; ShinJa et al., 2019). The increase in hemoglobin was achieved using Moringa leaf powder , Moringa leaf tea, Moringa leaves as biscuits, and a combination of soy milk and Moringa leaves. Specifically, the preparation of Moringa leaf products used for hemoglobin increase interventions is documented in Shinja et al., (2019) research. Additionally, Basri et al., (2022)found that using Moringa leaves during pregnancy with a three-month follow-up was effective in reducing stunting (Fitriyaa & Wijayanti, 2020; Khofifah & Mardiana, 2023)

Iron absorption in the body is influenced by the food consumed. Excessive consumption of calcium and fiber can inhibit iron absorption, while vitamin C, fish, meat, and poultry can enhance iron absorption. Moringa leaves are rich in complete nutrients such as vitamins, minerals, and essential amino acids. They also contain antioxidants, including vitamin C, which aids in iron absorption to form hemoglobin and distribute oxygen throughout the body. According to Fauziandari (2019)research, Moringa leaf extract can increase hemoglobin levels and serve as an alternative to address anemia. Iron sources can be both animal-based and plant-based. Animal-based iron sources include red meat, liver, and other animal products. Plant-based iron sources include green vegetables such as Moringa leaves, kale, spinach, mustard greens, broccoli, and others(Novita et al., 2022; Yusriani et al., 2022).

Research indicates that malnutrition or nutrient deficiency in the form of iron deficiency anemia can have widespread impacts, including reduced heat regulation, work capacity, gastrointestinal disorders, immune dysfunction, and decreased cognitive ability. Malnourished children may experience delays in motor development, as can children with iron deficiency anemia. Stunting is a condition where the body suffers from long-term or chronic malnutrition, often lasting years. Consequently, children may also experience other issues such as mental, psychomotor, and intellectual impairments if they suffer from prolonged malnutrition or early-onset stunting (Aryu, 2020). The first 1,000 days of a child's life are critical, marked by rapid brain growth. Therefore, malnutrition during this period can have both short-term and long-term effects on education, health, and productivity.

Differences in Hemoglobin Levels in Stunted Toddlers Before and After Moringa Leaf Intervention in the Control and Intervention Groups

Based on the analysis comparing scores between the control and intervention groups, there was a significant difference in the hemoglobin levels of stunted toddlers, with a p-value of 0.001. This indicates a significant difference in hemoglobin levels before and after the intervention in both the control and intervention groups. This finding proves that giving Moringa leaf porridge can increase hemoglobin levels in toddlers . Furthermore, Shinja et al. (2019) found an increase in hemoglobin levels in the intervention group from a baseline of 8.3 g/dL in children given Moringa leaf porridge to 13.6 g/dL after six months, compared to the control group, which increased from a baseline of 7.9 g/dL to 9.4 g/dL. Additionally, (Ponka et al., 2022)found that combining soy milk with Moringa leaf powder increased children's preference for the food, which could enhance the consumption of Moringa leaves among children, including those who are stunted, thereby affecting hemoglobin levels(Isnaini et al., 2023).

Moringa leaves are often called a superfood, meaning a food that contains unique compounds and is rich in nutrients needed by the body . Among eight superfoods, Moringa leaves are recognized as one of these essential foods in some regions. As explained by the Indonesian Ministry of Health (2018), Moringa leaves are rich in vitamins and minerals. Fresh Moringa leaves contain calcium (1007 mg), iron (6 mg), protein (5.1 mg), zinc (0.6 mg), vitamin A (6.78 mg), vitamin B1 (0.3 mg), and vitamin C (22 mg). Consuming Moringa leaves (Moringa oleifera) is an alternative to addressing malnutrition issues, including iron deficiency anemia. Anemia decreases significantly after consuming Moringa leaves (I. Isnaini, 2022) This study aligns with Irwan et al., (2020)which found that Moringa leaves have significant benefits for children's growth and development. The high calcium content in Moringa leaves can help increase children's height. Additionally, this study aligns with Hastuti & Sari (2022), which found that Moringa leaf tea is effective in increasing hemoglobin levels in women with anemia.

The research also supports (Fauziandari, 2019)which found that Moringa leaf extract can increase hemoglobin levels and serve as an alternative treatment for anemia. Functional porridge consisting of Moringa leaves, rosella flowers, and Ethiopian eggplants given to malnourished children aged 6-23 months can address anemia in stunted children (Saha et al., 2022; Ukwueze et al., 2018)

The Relationship Between Research Findings and Roy's Adaptation Model on the Effect of Moringa Leaf Products on Increasing Hemoglobin Levels in Stunted Toddlers

This study shows a significant difference in hemoglobin levels in stunted toddlers before and after being given an intervention with Moringa leaf products. The hemoglobin levels of stunted toddlers in the intervention group, who received Moringa leaf products, increased by an average of 1.1 g/dL, compared to the control group, which did not receive Moringa leaf products and showed an increase of only 0.3 g/dL. Roy's Adaptation Model originates from Helson's theory of social interaction. Helson stated that adaptive responses are natural reactions possessed by all individuals, both at the initial stimulus and until the individual reaches a certain level of adaptation. These responses result from adaptation, influenced by three types of stimuli from the environment: focal, contextual, and residual stimuli (Suzana et al., 2017). Focal stimuli focus on the direct effect of Moringa on increasing hemoglobin levels in children experiencing stunting. Consumption of Moringa can directly increase hemoglobin levels. Contextual stimuli refer to the measurement of hemoglobin levels after administering Moringa leaf porridge. Residual stimuli relate more to the inability to observe significant height changes after the intervention.

Additionally, Alligod (2017) emphasized that nursing interventions should aim to enhance adaptation by strengthening adjustment processes or converting stimuli into positive activities. This principle underpins the researcher's decision to provide Moringa leaf porridge as an intervention, ultimately enhancing the adaptation of families with stunted children.

Several studies have proven that Moringa leaves can increase hemoglobin levels, helping to address stunting issues. In applying Roy's model in this study, nurses play a role in preventing anemia in stunted toddlers by promoting the consumption of Moringa leaf products to increase hemoglobin levels. After consuming Moringa, children's hemoglobin levels will rise. Adaptation, in this context, was implemented by providing the intervention: Interventions focus on ways to achieve objectives. A nursing intervention is an action taken by a professional nurse that they believe will promote adaptive behavior by the client. Nursing interventions arise from solid foundational knowledge and are directed at focal stimuli whenever possible(Alligod, 2017; Nur et al., 2020)

An intervention is any nursing approach intended to enhance adaptation by strengthening adjustment processes or altering stimuli(Nur et al., 2020) This research aligns with Hastuti & Sari (2022) who found that Moringa leaf tea is effective in increasing hemoglobin levels in women with anemia. It also supports Fauziandari (2018), who concluded that Moringa leaf extract effectively increases hemoglobin levels in adolescent girls. Based on these findings, the researcher assumes that addressing anemia (low hemoglobin levels in the blood) in stunted toddlers requires nutritional intake, one of which is providing Moringa leaf products as an intervention. Several studies have identified Moringa leaves as a superfood rich in iron and protein, which can increase hemoglobin levels in the blood.

CONCLUSION

Based on the research results, it can be concluded that the respondents had an average age of 31.6 months, with the majority being male, having balanced nutritional status, engaging in active activities, and being accompanied by comorbidities. The average increase in hemoglobin levels in stunted toddlers on the first and eighth days in the control group was 0.3 g/dL. In the intervention group, the average increase in hemoglobin levels was 1.14 g/dL. There was a significant difference between the administration of Moringa leaf products and the increase in hemoglobin levels in stunted toddlers between the control and intervention groups, as evidenced by the t-test results with a p-value of 0.001, which is lower than $\alpha=0.05$ ($p<0.05$). This indicates that the administration of Moringa leaf products affects the increase in hemoglobin levels in stunted toddlers. There was no influence of confounding variables (age, gender, nutritional adequacy, physical activity, and comorbidities) on the hemoglobin levels of stunted toddlers, as indicated by the p-values: gender 0.39, age 0.23, nutritional adequacy 0.27, physical activity 0.27, and comorbidities 0.023.

REFERENCES

Abdullah, V. I., & Haumahu, C. . (2020). Pengaruh Konsumsi Cookies Kerang Dara (Anadara Granosa) terhadap Perubahan Kadar Haemoglobin Wanita Usia Subur. Journal of Holistic Nursing Science, 7(2), 169–179. https://doi.org/10.31603/nursing.v7i2.3126

Agustin, S. (2022). Memahami fungsi hemoglobin dan kadar normalnya dalam tubuh.

Akbar, C., Suketi, K., & Gema Kartika, J. (2019). Panen dan Pascapanen Kelor (Moringa oleifera Lam.) Organik di Kebun Organik Kelorina, Blora, Jawa Tengah. Buletin Agrohorti, 7(3), 247–254. https://doi.org/10.29244/agrob.v7i3.30171

Alligod, M. R. (2017). Pakar Teori Keperawatan (8th ed.). Elsevier.

Aryu, C. (2020). Buku epidemiologi stunting. Fakultas Kedokteran Universitas Diponegoro, Semarang.

Basri, H., Ansariadi, A., Hadju, V., Helmiyanti, S., Indriasari, R., Reski, R., Stang, S., Syam, A., & Zulkifli, A. (2022). Effect of Moringa Oliefera Supplementation During Pregnancy on Nutritional Status in Children 2–5 Years Old in Indonesia: A-Follow-Up Study. Current Developments in Nutrition, 6, 885. https://doi.org/https://doi.org/10.1093/cdn/nzac067.005

Dewi, E. K., & Susila Nindya, T. (2017). Hubungan Tingkat Kecukupan Zat Besi Dan Seng Dengan Kejadian Stunting Pada Balita 6-23 Bulan Correlation Between Iron and Zinc Adequacy Level With Stunting Incidence In Children Aged 6-23 Months. Amerta Nutrition, 1(4), 361–368. https://doi.org/10.20473/amnt.v1i4.2017.361-368

Fauziandari, E. N. (2019). Efektifitas Ekstrak Daun Kelor Terhadap Peningkatan Kadar Hemoglobin Pada Remaja Putri. Jurnal Kesehatan Karya Husada, 7(2), 24–29. https://doi.org/10.36577/jkkh.v7i2.230

Fitriyaa, M., & Wijayanti. (2020). Upaya Peningkatan Kadar Hemoglobin Melalui Suplemen Tepung Daun Kelor pada Remaja Putri. Prosiding University Research Colloquium, 4(2), 86–94. http://repository.urecol.org/index.php/proceeding/issue/view/21

Fuada, N., Setyawati, B., Salimar, S., & Purwandari, R. (2019). Hubungan Pengetahuan Makanan Sumber Zat Besi Dengan Status Anemia Pada Ibu Hamil. Media Gizi Mikro Indonesia, 11(1), 49–60. https://doi.org/10.22435/mgmi.v11i1.2324

Fuadah, D. Z., & Rahayu, N. F. (2018). Pemanfaatan POS Pembinaan Terpadu (POSBINDU) Penyakit tidak Menular (PTM) pada Penderita Hipertensi. Jurnal Ners Dan Kebidanan (Journal of Ners and Midwifery), 5(1), 020–028. https://doi.org/10.26699/jnk.v5i1.art.p020-028

Hastuti, A. P., & Sari, A. N. (2022). Remaja Dengan Anemia. Hastuti,Andrias Priyas Sari, Ajeng Novita, 5(1), 27–36.

Hastuty, M. (2020). Hubungan Anemia Ibu Hamil Dengan Kejadian Stunting Pada Balita Di UPTD Puskesmas Kampar Tahun 2018. Jurnal Doppler, 4(2), 112–116.

Iftikhar, A. (2018). Maternal Anemia and its Impact on Nutritional Status of Children Under the Age of Two Years. Biomedical Journal of Scientific & Technical Research, 5(3). https://doi.org/10.26717/bjstr.2018.05.001197

Irwan, Z., Salim, A., & Adam, A. (2020). Pemberian cookies tepung daun dan biji kelor terhadap berat badan dan status gizi anak balita di wilayah kerja Puskesmas Tampa Padang. AcTion: Aceh Nutrition Journal, 5(1), 45. https://doi.org/10.30867/action.v5i1.198

Isnaini, I. (2022). Synthesis of Silver Nanoparticles Balaccida Leaf Extract and Its Anti-Bacterial Activity of E. Coli. Indonesian Journal of Chemistry and Environment, 4(2), 57–64. https://doi.org/10.21831/ijoce.v4i2.48402

Isnaini, N., Faradhila, J., Maysarah, H., Prajaputra, V., & Harnelly, E. (2023). Patchouli and Essential Oil Products Trends in Formulation of Night Cream Containing Essential Oil. Journal of Patchouli and Essential Oil Products, 2(2), 33–40.

Kemenkes RI. (2022). Profil Kesehatan Indonesia 2022.

Khofifah, N., & Mardiana, M. (2023a). Biskuit daun kelor (Moringa oleifera) berpengaruh terhadap kadar hemoglobin pada remaja putri yang anemia. AcTion: Aceh Nutrition

Journal, 8(1), 43. https://doi.org/10.30867/action.v8i1.614

Khofifah, N., & Mardiana, M. (2023b). Biskuit daun kelor (Moringa oleifera) berpengaruh terhadap kadar hemoglobin pada remaja putri yang anemia. AcTion: Aceh Nutrition Journal, 8, 43. https://doi.org/10.30867/action.v8i1.614

Kurniawati, I., & Fitriyya, M. (2018). Karakteristik Tepung Daun Kelor Dengan Metode Pengeringan Sinar Matahari. Journal of Gizi Dan Pangan, 1, 238–243.

Manggul, M. S., Hidayanty, H., Arifuddin, S., Ahmad, M., Hadju, V., & Usman, A. N. (2021). Biscuits containing Moringa oleifera leaves flour improve conditions of anemia in pregnant women. Gaceta Sanitaria, 35, S191–S195. https://doi.org/https://doi.org/10.1016/j.gaceta.2021.07.013

Meikawati, W., Rahayu, D., & Purwanti, I. (2021). Berat Badan Lahir Rendah Dan Anemia Ibu Sebagai Prediktor Stunting Pada Anak Usia 12–24 Bulan Di Wilayah Puskesmas Genuk Kota Semarang. Media Gizi Mikro Indonesia, 13, 37–50. https://doi.org/10.22435/mgmi.v13i1.5207

Nasution, D., Nurdiati, D. S., & Huriyati, E. (2014). Jurnal Gizi Klinik Indonesia Berat badan lahir rendah (BBLR) dengan kejadian stunting pada anak usia 6-24 bulan. Jurnal Gizi Klinik Indonesia, 11(01), 31–37.

Nasution, Y. F., Lipoeto, N. I., & Yulizawati, Y. (2019). Hubungan kadar insulin-like growth factor 1 serum maternal dengan berat badan dan panjang badan bayi baru lahir pada ibu hamil KEK. Majalah Kedokteran Andalas, 42(3S), 19. https://doi.org/10.25077/mka.v42.i3s.p19-29.2019

Ningtyas, I., Handayani, D., & Kusumastuty, I. (2018). Pengetahuan Nutrition Facts dan Pemilihan Makanan Kemasan Mahasiswa Obesitas antara Metode Edukasi Personal dan Ceramah. Amerta Nutrition, 2(3), 271. https://doi.org/10.20473/amnt.v2i3.2018.271-282

Novita, Y., Athaillah, T., Husin, H., & ... (2022). Produk Inovasi Mie Kelor (Moringa Oleifera) Sebagai Upaya Pencegahan Stunting Desa Babul Makmur, Kecamatan Simeulue Barat …. Jurnal Abdimas Bina Bangsa, 3(1), 133–139.

Nur, R., Demak, I. P. K., Radhiah, S., Rusydi, M., Mantao, E., & Larasati, R. D. (2020). The effect of moringa leaf extracton increasing hemoglobin and bodyweight in post-disaster pregnant women. Enfermería Clínica, 30, 79–82. https://doi.org/https://doi.org/10.1016/j.enfcli.2019.10.045

Nurmalasari, Y., Anggunan, A., & Arivany, R. (2020). Hubungan Stunting dengan Kadar Hemoglobin dan Prestasi Belajar Pada Anak Sd Negeri 13 Teluk Pandan Pesawaran Tahun 2019. Jurnal Dunia Kesmas, 9(1).

Ponka, R., Zhung, P. M., Zomegni, G., Tchouape, C. G., & Fokou, E. (2022). Organoleptic and Physicochemical Properties of Soy-Milk Yoghurt Enriched with Moringa Oleifera Root Powder. Global Challenges (Hoboken, NJ), 6(5), 2100097. https://doi.org/10.1002/gch2.202100097

Pratiwi, W., & Nurjanna. (2019). Efek Pemberian Teh Daun Kelor (Moringa Oleifera Tea) Dan Tablet Tambah Darah Terhadap Peningkatan Kadar Haemoglobin Pada Remaja Anemia Di Kabupaten Sidrap. Jurnal Antara Kebidanan, 2, 101–111.

https://doi.org/10.37063/ak.v2i4.112

Saha, B. U. F., Choumessi, A. T., Ayamo, A. M., Kuagny, R. B. M., Teta, I., Nantia, E. A., & Ejoh, R. A. (2022). Nutritional Quality of Three Iron-Rich Porridges Blended with Moringa oleifera, Hibiscus sabdariffa, and Solanum aethiopicum to Combat Iron Deficiency Anemia among Children. Journal of Food Quality, 10(01), 4309892. https://doi.org/10.1155/2022/4309892

Salma, W. O., & Alifariki, L. O. (2021). Review, Riwayat Anemia Pada Kehamilan Sebagai Prediktor Kejadian Stunting Pada Anak: Literatur Review. Jurnal Ilmiah Obsgin, 13, 71–84.

ShinJa, L., SangSuk, L., SangSuk, L., EunTae, K. E. K., & JinSuk, J. J. J. (2019). Effect of optimal sodium stearoyl-2-lactylate supplementation on growth performance and blood and carcass characteristics in Hanwoo steers during the early fattening period. Asian-Australasian Journal of Animal Sciences, 31(9), 1442–1448.

Sinaga, T. R., Purba, S. D., Simamora, M., Pardede, J. A., & Dachi, C. (2021). Berat Badan Lahir Rendah dengan Kejadian Stunting pada Batita. Jurnal Ilmiah Permas: Jurnal Ilmiah STIKES Kendal, 11(3), 493–500. https://doi.org/10.32583/pskm.v11i3.1420

Sumarni, & Syarif, S. (2020). Efektifitas Pemberian Kombinasi Jus Bayam, Sunkist, Madu Terhadap Peningkatan Kadar Haemoglobin Pada Ibu Hamil Anemia Di Puskesmas Dahlia Kota. Jurnal Antara Kebidanan, 3(1), 69–76.

Ukwueze, C. S., Anene, B. M., Ezeokonkwo, R. C., & Nwosuh, C. I. (2018). Prevalence of canine parvovirus infection in South Eastern region, Nigeria. World Development, 1(1), 1–15. http://www.fao.org/3/I8739EN/i8739en.pdf%0Ahttp://dx.doi.org/10.1016/j.adolescence.2017.01.003%0Ahttp://dx.doi.org/10.1016/j.childyouth.2011.10.007%0Ahttps://www.tandfonline.com/doi/full/10.1080/23288604.2016.1224023%0Ahttp://pjx.sagepub.com/lookup/doi/10

unicef. (2023). Mal Nutrition.

Widiwurjani, Guniarti, & Andansari, P. (2019). Status Kandungan Sulforaphane Microgreens Tanaman Brokoli (Brassica Oleracea L.) Pada Berbagai Media Tanam Dengan Pemberian Air Kelapa Sebagai Nutrisi. Jurnal Ilmiah Hijau Cendekia, 84(4), 330–330. https://doi.org/10.2493/jjspe.84.330

Winarno, F. G. (2018). Tanaman Kelor (Moringa Oleifera) Nilai Gizi, Manfaat, Dan. Potensi Usaha. Gramedia.

Yusriani, Rosada, I., & Alwi, M. K. (2022). Program Kemitraan Masyarakat Kelompok Petani Dalam Penerapan Diversifikasi Produk Olahan Daun Kelor Untuk Pencegahan Stunting. Jurnal Pengabdian Kepada Masyarakat, 5(2), 7–12.