Journal of Chemical Health Risks

www.jchr.org

JCHR (2024) 14(1), 2490-2495 | ISSN:2251-6727

Effect of Moringa Oliefera Supplementation During Pregnancy on Stunting in Children of Pre-School Age (5 - 6 Years) in Jeneponto District, Indonesia: A Follow-Up Study

***Nur Hikmah[1], Veni Hadju[2], Andi Razak Thaha[2], Burhanuddin Bahar[2], Andi Zulkifli[3], Syamsiar S. Russeng [4], Hasan Basri[5]**

[1] Faculty of Public Health, Hasanuddin University, Makassar, Indonesia

[2] Department of Nutrition Science, Faculty of Public Health, Hasanuddin University,Makassar, Indonesia

[3] Department of Epidemiology, Faculty of Public Health, Hasanuddin University, Makassar, Indonesia

[4] Department of Occupational Health and Safety, Faculty of Public Health, Hasanuddin University, Makassar, Indonesia

[5] Post-Doct of Nutrition Science, Faculty of Public Health, Hasanuddin University, Makassar, Indonesia

*Corresponding Author:

(**Received**: 27 November 2023 **Revised**: 22 December **Accepted**: 06 January)

KEYWORDS

Pregnant Women, Moringa Leaf, Child Nutrient Intake, Stunting

ABSTRACT:

Introduction: Stunting is a growth failure due to a lack of nutrition that has lasted from pregnancy to 24 months of age. The provision of moringa during pregnancy is an effort to improve the nutritional status of pregnant women, which is one of the efforts to reduce the prevalence of stunting.

Objectives: This study seeks to see the effect of moringa supplementation during pregnancy on stunting in preschool children (5-6 years old).

Methods: This study is a follow-up study of a Randomized Control Trial with Double Blind study that provides moringa supplements in the form of PG (Powder Group), EG (Extract Group), and as well as IFA (Iron Folate Acid) supplements to pregnant women. The subjects were 303 children in six sub-districts in Jeneponto District who were children of mothers who received supplementation of PG, EG, and IFA during pregnancy. Children's height was measured using a microtoice. Data were statistically analyzed using the Logistic Regression test.

Results: The results showed a significant difference between the three groups. EG intervention had a significant effect on stunting in preschool-age children (5-6 years old). EG intervention (24.18%) showed the lowest prevalence of stunting among PG (25.47) and IFA (38.68%) interventions. EG prevented stunting by 2.215 times compared to the other intervention groups.

Conclusions: The provision of Moringa extract to pregnant women has a better effect on reducing stunting.

1. Introduction

Stunting is a condition where a person's height is smaller than that of a person of the same age (1). Stunting is a linear growth disorder, due to malnutrition due to lack of nutrient intake, and chronic infectious diseases, which is characterized by a height-for-age z-score (HAZ) of less than two standard deviations (2). The problem of stunting is not caused by one factor but is caused by multi-factor (3). Stunting is a process of stunted child growth, which occurs due to chronic malnutrition conditions (4). The short-term effect of stunting is impaired child growth and the long-term effect is child development (5). This 1000 HPK period is a critical period at the beginning of life (6). Some of the direct causes of stunting in children are inadequate nutritional intake, infectious diseases, and poor parenting (7). Indirect factors affecting stunting include parenting, parents, income, maternal knowledge, and consumption patterns, and direct factors are genetics, intake, and infectious diseases (5,7).

The prevalence of stunting is 22% or 149.2 million children under 5 years globally by 2020. The prevalence of stunted children in Indonesia in 2018 was 30.8% (8). Then there was a decrease in 2019 the stunting rate was around 27.7% (9), a decrease of 24.40% in 2021 (10), and 21.6% in 2022 (11). The prevalence of stunting in South Sulawesi ranks 10th highest in Indonesia at 27.2%.

Journal of Chemical Health Risks

www.jchr.org

JCHR (2024) 14(1), 2490-2495 | ISSN:2251-6727

Similarly, Jeneponto Regency has the highest prevalence of stunting in South Sulawesi at 39.8% (11). One of the local foods that are rich in nutrients is Moringa Oleifera or commonly known as Moringa leaves. Moringa trees are very easy to grow in Indonesia and that is very common in the South Sulawesi area (12) and this plant usually grows in dry places (13). A comparative study of fresh Moringa leaves when compared to other foods contains 7 times the vitamin C of oranges, 4 times the vitamin A of carrots, 4 times the calcium of milk, 3 times the potassium of bananas, and 2 times the protein of yogurt (14). Moringa Oleifera leaves are rich in macronutrients and micronutrients such as calcium, potassium, zinc, magnesium, iron, and copper (15). Moringa content is effective in increasing haemoglobin (Hb) concentration, which plays the same role as iron-folate supplementation (16). Providing moringa leaf extract can also help repair DNA and can prevent underweight at birth which is a trigger for stunting (17). Moringa leaves contain several essential amino acids that are very beneficial for tissue growth in the fetus (18). Interventions with moringa supplementation for pregnant women, infants, and toddlers' nutritional status can prevent stunting in children.

The results of previous research on children aged 2-5 years showed a decrease in stunting cases in the EG group (14). Although previous interventions have shown the effect of moringa supplementation in children under five years of age, it is still necessary to see further the consistency of the effect of moringa leaf extract supplementation on children's nutritional status. Therefore, this study aims to examine the effect of moringa supplementation during pregnancy on stunting in preschool children (5-6 years old).

2. Objectives

Therefore, this study aims to examine the effect of moringa supplementation during pregnancy on stunting in preschool children (5-6 years old).

3. Methods

This study is a longitudinal follow-up study of an experimental study with a randomized clinical trial (RCT)-double-blind method since the second trimester of pregnancy. This study was conducted in Jeneponto Regency using 3 forms of intervention, namely moringa extract supplementation (EG), moringa flour (PG), and iron/folic acid tablets (IFA). The samples in this study were pre-school-age children (5-6 years old) with details of 106 PG samples, 106 IFA samples, and 91 EG samples.

Data collection in the field was carried out by enumerators who had attended and passed the training. The qualifications of enumerators were those with a minimum education of S1 Nutrition Science or other health majors. Data on household and child characteristics were collected through interviews using a questionnaire. Height measurements were taken using a microtoice twice as a form of measurement calibration. Stunting was defined based on WHO standards (HAZ <-2 SD). Determination of z-score values using the WHO Anthro Plus application.

Data were analyzed using the SPSS software application. Then the data was processed by univariate analysis, bivariate analysis, and multivariate analysis. The univariate analysis aims to describe the characteristics of each variable. Then bivariate analysis was conducted to determine the relationship between 2 variables with the Chi-Square Test. Followed by multivariate analysis to determine the effect of other variables on stunting. The statistical test performed was logistic regression, where the variables included in the model had a p-value <0.25. The value of statistical significance of the relationship when the p-value <0.05.

4. Results

The results of the study in **Table 1** show the characteristics of child age, child birth weight, exclusive breastfeeding status, father's education, mother's occupation, and family income where there are 90 stunting cases. Table 1 also shows that the p-value of characteristic risk factors (child's age, child's birth weight, child's exclusive breastfeeding status, father's education, mother's occupation, and family income) in the analysis of the difference between characteristic risk factors and stunting has a p-value> 0.05. This indicates that there is no influence between the intervention group (child's age, child's birth weight, child's exclusive breastfeeding status, father's education, mother's occupation, and family income) and stunting.

Journal of Chemical Health Risks

www.jchr.org

JCHR (2024) 14(1), 2490-2495 | ISSN:2251-6727

Table 1. Analysis of Differences between Risk Factors and Stunting in Pre-School 5-6 years old in Jeneponto District

Characteristics	HAZ (HAZ)						p
	Stunting		Normal		N	%	
	n	%	N	%			
ge of Child							
60 - 70 months	78	31.7	168	68.3	246	100	0.113
71 - 81 months	12	21.1	45	78.1	57	100	
irth weight							
Normal	86	29.7	204	70.3	290	100	0.931
LBW	4	30.8	9	69.2	13	100	
xclusive breastfeeding							
Exclusive	42	32.1	89	67.9	131	100	0.433
Not Exclusive	48	27.9	124	72.1	172	100	
ither's Education							
Not in School	6	40.0	9	60.0	15	100	0.203
Not graduated primary school	9	42.9	12	57.1	21	100	
Elementary school graduate	33	29.2	80	70.8	113	100	
Not graduated junior high school	3	75.0	1	25.0	4	100	
Junior high school graduate	14	26.9	38	73.1	52	100	
High school graduate	17	22.4	59	77.6	76	100	
Not graduated high school	0	0.00	2	100	2	100	
Bachelor's Degree	6	35.3	11	64.7	17	100	
other's Occupation							
Work	9	29.00	22	71	31	100	0.931
Housewife	81	29.8	191	70.2	272	100	
mily Income							
Low (<2.4 million)	75	31.6	162	69.4	237	100	0.161
High (≥2.4 million)	15	22.7	51	77.3	66	100	

Based on **Table 2**, the frequency distribution of HAZ nutritional status shows that there are 90 samples (29.7%) stunted and there are 213 samples (7 0.3%) normal / not stunted. The frequency distribution of IMT/U nutritional status shows that there are 32 samples (10.6%) wasting and there are 271 samples (89.4%) normal / not wasting. The frequency distribution of BB/U nutritional status shows that there are 93 samples (30.7%) underweight and there are 210 samples (69.3%) of normal nutrition. Table 2 also shows that the p-value in the frequency distribution of wasting nutritional status has a p-value> 0.05 so it can be concluded that there is no difference between the intervention groups when pregnant women with wasting variables. However, in the frequency distribution of stunting and underweight, the p-value <0.05 so it can be concluded that there is a difference between the intervention groups when the mother is pregnant with the variables of stunting and underweight.

Table 2. Analysis of Nutritional Status-based Groups in Pre-school Children 5-6 years old in Jeneponto District

Nutrition Status	PG		IFA		EG		Total		p
	n	%	n	%	N	%	n	%	
HAZ (HAZ)									
Stunting	27	8.9	41	13.5	22	7.3	90	29.7	0.042
Normal	79	26.1	65	21.5	69	22.8	213	70.3	
WHZ (IMT/U)									
Wasting	13	4.3	6	2.0	13	4.3	32	10.6	0.113
Normal	93	30.7	100	33.0	78	25.7	271	89.4	
WAZ (BW/U)									
Underweight	40	13.2	23	7.6	30	9.9	93	30.7	0.035
Normal	66	21.8	83	27.4	61	20.1	210	69.3	

Table 3 shows that children who received EG intervention during pregnancy affected on the incidence of stunting (p<0.01). The provision of EG prevented the incidence of stunting by 2.215 times compared to other intervention groups. The other variables showed no effect on the incidence of stunting in preschool children aged 5-6 years in Jeneponto Regency.

Table 3. Multivariate Analysis of the Effect of Interventions on Stunting in Pre-school Children 5-6 years old in Jeneponto Regency

Variables	p	OR	95% C.I	
			Lower Limit	Upper Limit
Intervention				
PG	0.074	1.744	0.947	3.214
EG	0.015	2.215	1.167	4.202
IFA	0.036	ref	ref	ref
Child Age (60-70 months)	0.092	0.535	0.258	1.107
LBW	0.796	1.178	0.341	4.073
Breastfeeding (Not Exclusive)	0.572	1.162	0.690	1.954
Father's Education (Low)	0.232	0.728	0.432	1.226
Mother's Occupation (Working)	0.816	0.903	0.384	2.126
Family Income (Low)	0.431	1.319	0.662	2.628

5. Discussion

Results of the study on children aged 5-6 years showed that the EG intervention had a significant effect on stunting. EG intervention (24.18%) showed the lowest prevalence of stunting among PG (25.47%) and IFA (38.68%) interventions. EG prevented the incidence of stunting by 2.215 times compared to the other intervention groups. In Jeneponto District, a study was conducted on the effects of PG, IFA, and EG interventions on stunting from birth to 5 years of age, followed by a study on the same intervention groups at the age of 5-6 years. Results of the study in children aged 0-6 months showed a

Journal of Chemical Health Risks

www.jchr.org

JCHR (2024) 14(1), 2490-2495 | ISSN:2251-6727

significant increase in child weight in the PG and IFA groups but not in the body length of children given colostrum. In the PG intervention, the number of stunted children at 0 months of age was 2.7% while the IFA intervention was higher at 3.3%. In the age range of 2-5 months, the prevalence of stunting was highest in the PG intervention, which increased every month. EG and IFA interventions at 2-5 months showed better results than the PG intervention (18).

Then, the results of the study at the age of 6-12 months showed an increase in body weight and length in both the PG and IFA intervention groups. In this age range, the incidence of stunting fluctuated greatly in all intervention groups, but there was little consistency in the IFA group. So at the age of 12 months shows the highest prevalence of stunting in the extract which is 30.9% then 28.2% in the PG intervention and as much as 23.4% in the IFA group. So it was concluded that in the age range of 6-12 months, the IFA intervention showed better results (19).

Similarly, results of the study at the age of 12-17 months showed nutritional status that was not much different from the prevalence of stunting at the previous age, but at the age of 18-24 months showed different results from the previous age where the EG intervention group had fewer stunting incidents than the other intervention groups. In the EG intervention group, the prevalence of stunting reached 41.7%, which is lower than the PG intervention which reached 48.7%, and the IFA intervention which reached 42%. It can be concluded that at 24 months of age, the EG intervention is much better than PG and offsets the effect of the control group or in this case IFA (20).

Results of the study in children aged 2-3 years showed that the prevalence of stunting in children was highest in the PG intervention (51.8%), then lower interventions in EG (39.3%) and IFA (37.8%), respectively. The PG intervention increased the prevalence of stunting in children with a risk of 1.787 times compared to the IFA intervention. The EG intervention can prevent stunting in 2-3-year-olds (21,22). The results of a study in children aged 3-4 years showed that the EG intervention had a significant effect on reducing the incidence of stunting in children aged 36-42 months. The EG intervention (25.2%) showed the lowest prevalence of stunting among other interventions such as PG (41.5%) and IFA (33.3%). Administration of Moringa oleifera extract during pregnancy can prevent stunting in children aged 34-42 months (22). The results of research on children aged 4-5 years showed that the prevalence of stunting in the three groups was significantly different and the lowest group was in the EG intervention (21.4%). Thus, the results of this study indicate that there is a decrease in stunting cases in EG group children from 0 months of age to 6 years of age. Moringa leaf extract showed better results in preventing stunting. Likewise, in the PG group, there was a decrease in stunting cases although not significant as presented in Figure 1 (21).

The macronutrient and micronutrient content of moringa extract has a very important function in improving pregnancy outcomes and preventing stunting in children (23). In a previous study, there was a difference in the effect given between moringa extract and moringa flour in preventing the prevalence of stunting. Moringa leaf extract showed a more positive effect in preventing stunting because moringa flour is obtained in powder form from drying (heating) so that the active chemicals in moringa are lost, while moringa extract is obtained from extracted moringa leaves that take all the active chemicals from moringa (24). In making moringa flour into 500 mg capsules, only a few moringa leaves are needed, while in making moringa extract into capsules, many moringa leaves are needed to be made into 500 mg moringa extract, so that there is more moringa nutritional content in the extract (25). The active chemicals (phytochemicals) in moringa extract were found to be very much like flavonoids, alkaloids, steroids, carotenoids, and other chemicals where these various active chemicals contained many benefits in improving the nutritional status of mothers and children (26).

Laboratory examination results per each moringa extract capsule showed that the flavonoid/alkaloid content was 301.237 ppm. Some previous studies have shown that the flavonoid content of moringa extract using water extraction is around 11-15 grams/100 grams but will be greater if moringa extract uses ethanol/methanol extraction (23). The function of flavonoids is as an anti-cancer, anti-oxidant that can ward off free radicals, and prevent and improve malnutrition in children (27).

Results of previous studies show that there is an effect of giving moringa extract during pregnancy can reduce the prevalence of stunting because moringa extract can improve pregnancy outcomes better and this relationship cannot be separated from the prevention of stunting in children (22). In a study on the efficacy of Moringa Oliefera in malnourished children, it showed that stunting in children who received Moringa at the beginning of the study was -2.6±1.8 and increased to -2.1± 2.0 at the end of the study. In addition, the group of children given moringa showed significant changes in nutritional status

Journal of Chemical Health Risks

www.jchr.org

JCHR (2024) 14(1), 2490-2495 | ISSN:2251-6727

in the WAZ and HAZ z values. This study suggests that moringa can improve the nutritional status of children. Giving moringa leaf extract to pregnant women has a better effect on reducing the prevalence of stunting in children aged 4-5 years.

6. Conclusion

There is an effect of providing PG, IFA, and EG interventions on stunting in children from the age of 2 years to 6 years, where the provision of EG intervention is better than other interventions. The results of the study in children aged 5-6 years showed that children who received EG intervention during pregnancy affected the incidence of stunting ($p<0.01$). The provision of EG prevents the incidence of stunting by 2.215 times compared to other intervention groups.

Refrences

1. Ministry Of Health Of The Republic Of Indonesia. REGULATION OF THE MINISTER OF HEALTH OF THE REPUBLIC OF INDONESIA. 2020.
2. Fauzatul Hidayati N, Nurhayati T. RISK FACTORS ASSOCIATED WITH STUNTING IN CHILDREN UNDER FIVE: LITERATURE STUDY Risk Factors Related To Stunting In Children Under Five : Literature Study. Journal Of Medical Medicine. 2022;13(01):31–42.
3. Beal T, Tumilowicz A, Sutrisna A, Izwardy D, Neufeld LM. A Review Of Child Stunting Determinants In Indonesia. Maternal And Child Nutrition. 2018;14(4):1–10.
4. WHO. World Health Statistics 2018. Vol. 10, World Health Organization. Geneva; 2018.
5. Sulistyaningsih DA, Panunggal B, Murbawani EA. URINE IODINE STATUS AND IODINE INTAKE IN STUNTED CHILDREN AGED 12-24 MONTHS. Indonesian Micronutrient Media. 2018 Dec;9(2):73–82.
6. Titaley CR, Ariawan I, Hapsari D, Muasyaroh A, Dibley MJ. Determinants Of The Stunting Of Children Under Two Years Old In Indonesia: A Multilevel Analysis Of The 2013 Indonesia Basic Health Survey. Nutrients. 2019 May;11(5).
7. Zakaria, Hadju V, As'ad S, Bahar B. Effect Of Extract Moringa Oleifera On Quantity And Quality Of Breastmilk In Lactating Mothers, Infants 0-6 Month. MKMI Journal. 2016;12(3):161–9.
8. Ministry Of Health Of The Republic Of Indonesia. Main Results Of Riskesdas 2018 Province. Riskesdas. 2018.
9. Ministry Of Health Of The Republic Of Indonesia. Study On Nutritional Status Of Indonesian Toddlers Integrated Susenas 2019. Balitbangkes Kemenkes RI. 2019.
10. Ministry Of Health Of The Republic Of Indonesia. Pocket Book Of SSGI Indonesia Nutritional Status Study Results In 2021. Jakarta; 2021.
11. Ministry Of Health Of The Republic Of Indonesia. Results Of The 2022 Indonesian Nutritional Status Survey (SSGI). Jakarta; 2022.
12. Hastuti, Hadju V, Citrakesumasari, Maddeppungeng M. Stunting Prevalence And Its Relationship To Birth Length Of 18–23 Months Old Infants In Indonesia. Enfermeria Clinica. 2020;30:205–9.
13. Khan AV, Uddin Ahmed Q, Khan AA, Shukla I. In Vitro Antibacterial Efficacy Of Leucas Cephalotes (Roth) Spreng. (Lamiaceae) Against Some Gram Positive And Gram Negative Human Pathogens. International Journal Of Agricultural And Food Research. 2014 Dec;3(3).
14. Isnan W, M N. VARIOUS BENEFITS OF MORINGA PLANTS (Moringa Oleifera Lamk.) FOR THE COMMUNITY. EBONI Technical Info Vol. 2017;14(1):63–75.
15. Gopalakrishnan L, Doriya K, Santhosh D. Moringa Oleifera : A Review On Nutritive Importance And Its Medicinal Application. Food Science And Human Wellness. 2016;5(2):49–56.
16. Nadimin, Hadju V, As S, Buchari A. The Extract Of Moringa Leaf Has An Equivalent Effect To Iron Folic Acid In Increasing Hemoglobin Levels Of Pregnant Women : A Randomized Control Study In The Coastal Area Of Makassar. International Journal Of Sciences: Basic And Applied Research (IJSBAR). 2015;22(1):287–94.
17. Nadimin, Hadju V, As S, Buchari A, Haruna I, Hartono R. Increasing Of Nutrition Status Of Pregnant Women After Supplementation Of Moringa Leaf Extract (Moringa Oliefera) In The Coastal Area Of Makassar, Indonesia. 2019.
18. Ulmy MN, Tahir A, Arsunan AA, Burhanuddin B, Veni H. Effect Of Moringa Leaves During Pregnancy On Growth And Morbidity In 0–5 Months. Enfermeria Clinica. 2020;30:61–5.

19. Sumiaty, Tahir A, Burhanuddin B, Nurhaedar J, Veni H. The Effect Of Moringa Leaves On Pregnancy On Growth And Morbidity Of 6–11 Month. Enfermeria Clinica. 2020;30:104–8.
20. Sarih K, Siradjuddin S, Maddepungeng M, Hadju V, Saleh A, Tanziha I, Et Al. Moringa Oleifera Intake During Pregnancy And Breastfeeding Toward Docosahexaenoic Acid And Arachidonic Acid Levels In Breast Milk. Open Access Macedonian Journal Of Medical Sciences. 2020;8:757–61.
21. Basri H, Hadju V, Zulkifli A, Sham A, Ansariadi A, Stang S, Et Al. 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. 2022;6(Supplement_1):885–885.
22. Basri H, Hadju V, Zulkifli A, Syam A, Indriasari R. Effect Of Moringa Oleifera Supplementation During Pregnancy On The Prevention Of Stunted Growth In Children Between The Ages Of 36 To 42 Months. Journal Of Public Health Research. 2021;10(2):1–6.
23. Lin M, Zhang J, Chen X. Bioactive Flavonoids In Moringa Oleifera And Their Health-Promoting Properties. Journal Of Functional Foods. 2018;47(April):469–79.
24. Baldisserotto A, Buso P, Radice M, Dissette V, Lampronti I, Gambari R, Et Al. Moringa Oleifera Leaf Extracts As Multifunctional Ingredients For "Natural And Organic" Sunscreens And Photoprotective Preparations. Molecules. 2018;23(3).
25. Basri H, Hadju V, Zulkifli A, Syam A. STUNTED AND STIMULATION AFFECT CHILD DEVELOPMENT IN JENEPONTO DISTRICT , INDONESIA. Turkish Journal Of Physiotherapy And Rehabilitation. 2021;32(3):15018–22.
26. Gull I, Javed A, Aslam MS, Mushtaq R, Athar MA. Use Of Moringa Oleifera Flower Pod Extract As Natural Preservative And Development Of SCAR Marker For Its DNA Based Identification. Biomed Research International. 2016;2016.
27. Kasolo JN, Bimenya GS, Ojok L, Ochieng J, Ogwal-Okeng JW. Phytochemicals And Uses Of Moringa Oleifera Leaves In Ugandan Rural Communities. Journal Of Medicinal Plants Research. 2010;4(9):753–7.