



The Effect of *Moringa oleifera* on Pregnant Women and Breastfeeding Mothers toward Social-personal Development of Children Aged 18–23 Months in Jeneponto, South Sulawesi

Hastuti Hastuti^{1*}, Veni Hadju², Citrakesumasari Citrakesumasari², Martira Maddeppungeng³, Ikeu Tanziha⁴, Aryanti Saleh⁵, Karmila Sarih⁶

¹Doctoral Student in Public Health, Universitas Hasanuddin, Makassar, Indonesia; ²Department of Nutrition, Faculty of Public Health, Universitas Hasanuddin, Makassar, Indonesia; ³Departement of Child, Wahidin Sudirohusodo Hospital, Makassar, Indonesia; ⁴Department of Community Nutrition, Institut Pertanian Bogor, Bogor, Indonesia; ⁵Department of Nursing, Nursing Faculty, Universitas Hasanuddin, Makassar, Indonesia; ⁶Department of Nursing, Anging Mammiri Diploma of Nursing, Makassar, Indonesia

Abstract

BACKGROUND: Insufficient nutrition intake at the age of <2 years has an impact on decreasing physical growth and development.

AIM: Analyzing the effect of giving *Moringa* leaves on pregnant women and breastfeeding mothers toward the social development of children aged 18–23 months in Jeneponto, South Sulawesi.

METHODS: This study was a longitudinal study after supplementation for pregnant women and breastfeeding mothers with *Moringa oleifera* or folic acid, and iron. Research subjects were children whose was monitored from the age of 18–23 months in Jeneponto District. The number of samples that met the inclusion criteria at the age of 23 months was 344 children. The sample was divided into three groups: A group of children of mothers who got *Moringa* leaf powder supplements, iron-folic acid supplements, and *Moringa* leaf extract. Child development was measured using the denver development screening test. Data were analyzed statistically with Chi-square.

RESULTS: There were 107 children (91.5%) with normal social-personal development in the *Moringa* leaves powder (MLP) group. This number was more than the children in the iron folic acid (IFA) group of 103 children (86.6%) and the *Moringa* leaves extract (MLE) group of 95 children (88.0%). Differences were also found in the social-personal development of children who were suspect in the IFA group more than children who were suspect in the MLP group or the MLE group.

CONCLUSION: There was no significant difference in children's social-personal development between the three study groups.

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***Correspondence:** Hastuti Hastuti, Doctoral Student

in Public Health, Universitas Hasanuddin, Makassar,

Indonesia. E-mail: tuti311270@gmail.com

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Veni Hadju, Citrakesumasari Citrakesumasari,

Martira Maddeppungeng, Ikeu Tanziha, Aryanti Saleh,

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Introduction

Nutrition problems of toddlers and maternal health still require more serious attention. It is shown by the high incidence of malnutrition and poor nutrition reaching 17.7%. Toddler short (stunt) and very short (severely stunted) reach 30.8%, while very skinny and skinny toddlers reach 10.2%. The incidence of chronic energy deficiency in pregnant women is 17.3%, and pregnant women with anemia are 48.9%. The infant mortality rate reaches 24/100 thousand population, and the current maternal mortality ratio reaches 346/100 thousand population, while the 2019 target is 306/100 thousand population [1].

Inadequate nutritional intake, infection, and poor care are direct causes of malnutrition in infants and children. It has an impact not only on macronutrient deficiencies but also micronutrients that are indispensable for the growth and development of early childhood. The

efforts to improve infant nutrition are based on the fact that malnutrition at <2 years of age has an impact on reducing physical growth, development, intelligence, and productivity. These impacts are largely irreversible [2].

Micronutrients are needed for brain development during gestation and infancy. This period is substantial for brain development and the formation of a foundation for the development of cognitive, motor, and socioemotional skills during childhood. More than 200 million children aged <5 years in low- and middle-income countries have conservative estimates that they do not reach development potential [3].

Children's social-personal development is an aspect related to the ability of independence, socializing, and interacting with the environment. Personal development includes various abilities grouped as habits, personality, character, and emotions. All of them experience changes in their development. The closeness or bonding of infants to adults is subject to the stages of social development.

The efforts to fulfill micronutrients utilize the potential of local resources to make them easily accessible to the community and are sustainable. One of the potentials of local foodstuffs contains high micronutrients and is widely available but not yet utilized maximally is *Moringa oleifera* leaves. *Moringa* is easily found in all parts of Indonesia, including in South Sulawesi.

A research on malnourished communities in Senegal, Africa reports that *Moringa* leaf flour therapy can significantly improve an individual's nutritional status. The use of *Moringa* as a source of supplementary food is an effort to overcome malnutrition [4], [5]. *Moringa* leaves have considerable potential for nutrients, contain a number of amino acids, and several kinds of important micronutrients, such as Vitamin A, Vitamin C, Vitamin E, iron, calcium, zinc, and selenium [6].

To maximize the development of children, especially their social-personal development, it is necessary to conduct a research on the effects of *M. oleifera* leaves on pregnant women and breastfeeding mothers toward social-personal development of children aged 18–23 months in Jeneponto, South Sulawesi, Indonesia.

Materials and Methods

Design and location

This research is a longitudinal study after supplementation for pregnant women and nursing mothers with *Moringa oleifera* or iron folic acid (IFA) in six sub-districts in Jeneponto Regency which is one of the districts in South Sulawesi with diverse topographic conditions. Some areas are highlands or mountains, and some coastal areas and lowlands.

Participant

Research subjects were children whose development was monitored from 18 months to 23 months. At the beginning of the study, the total sample was 438 children. The number of samples was reduced because some subjects did not meet the inclusion criteria, refused to participate, moved to other areas which caused researchers to not be able to follow-up. The number of samples that could be measured at 23 months was 344 children.

Procedure

Several factors related to growth during infancy have previously been measured including family characteristics, maternal conditions during pregnancy and breastfeeding, breastfeeding history,

and supplementary feeding. In addition, nutritional care during the 1st year of life is obtained through direct interviews using research forms. Furthermore, children's development was measured using the Denver development screening test (DDST).

Instruments

The DDST is an assessment method that is widely used to assess the development progress of children aged 0–6 years, detect problems in severe child development and as a quick method to identify children who need further evaluation. This test is not a diagnostic test or an intelligence quotient (IQ) test [7]. The DDST consists of developmental task items that are suitable for a child's age from 0 to 6 years old.

Statistical analysis

The effect of giving *Moringa* leaves on a child's development was measured using the Chi-square test.

Results

Characteristics of pregnant and breastfeeding mothers

Table 1 shows that there are no significant differences in the characteristics of pregnant women and breastfeeding mothers ($p > 0.05$). It means that these three research groups have equality or similarity especially in age, frequency of delivery (parity), ante natal care, post-natal care, and mother's knowledge about the benefits of breastfeeding.

Table 1: Characteristics of pregnant and breastfeeding mothers in Jeneponto Regency, 2019

Variables	MLP (n = 117)		IFA (n = 119)		MLE (n = 108)		Total (n = 344)		p*
	n	%	n	%	n	%	n	%	
Mother's age									
20 – 35 yo	86	73.5	82	68.9	79	73.1	247	71.8	0.685
<20 and >35 yo	31	26.5	37	31.1	29	26.9	97	28.2	
Parity									
1	31	26.5	46	38.7	31	28.7	108	31.4	0.101
>1	86	73.5	73	62.3	77	71.3	236	68.6	
Ante natal care (times)									
<4	64	54.7	80	67.2	72	66.7	216	62.8	0.083
>4	53	45.3	39	32.8	36	33.3	128	37.2	
Post-natal care									
Yes	24	20.5	32	26.9	22	20.4	78	22.7	0.397
No	93	79.5	87	73.1	86	79.6	266	77.3	
Benefits of breastfeeding									
Aware	78	66.7	89	74.8	72	66.7	239	69.5	0.298
Not aware	39	33.3	30	25.2	36	33.3	105	30.5	

*Chi-square; MLP: *Moringa* leaves powder; IFA: Iron folic acid; MLE: *Moringa* leaves extract

Child characteristics

Table 2 shows that the birth length of children is significant in all three groups ($p = 0.034$) but there are no significant differences in sex, birth weight, birth process,

place of birth, colostrum, prelacteal, breastfeeding, complementary feeding, and immunization between the three research groups ($p > 0.05$). It illustrates that the three groups of research subjects have similarities in terms of gender, birth weight, birth process, place of birth, colostrum, prelacteal, breastfeeding, complementary feeding, and immunization.

Table 2: Characteristics of children aged 18-23 months in Jeneponto Regency, 2019

Variables	MLP (n=117)		IFA (n=119)		MLE (n=108)		Total (n=344)		p*
	n	%	n	%	n	%	n	%	
Sex									
Male	64	54.7	66	55.5	60	55.6	190	55.2	0.990
Female	53	45.3	53	44.5	48	44.4	154	44.8	
Birth weight									
≥2500	114	97.4	111	93.3	104	96.3	329	95.6	0.271
<2500	4	2.6	8	6.7	4	3.7	15	4.4	
Birth length									
≥48 cm	105	89.7	93	78.2	94	87.0	292	84.9	0.034*
<48 cm	12	10.3	26	21.8	14	13.0	52	15.1	
Birth process									
Normal	114	97.4	111	93.3	99	91.7	324	94.2	0.158
Section secaria	3	2.6	8	6.7	9	8.3	20	5.8	
Place of birth									
Medical facility	106	90.6	107	89.9	102	94.4	314	91.3	0.371
House	11	9.4	12	10.1	6	5.6	30	8.7	
Colostrum									
Yes	105	89.7	107	89.9	102	94.4	314	91.3	0.371
No	12	10.3	12	10.1	5	5.6	30	8.7	
Prelacteal									
No	90	76.9	88	73.9	84	77.8	262	76.2	0.774
Yes	27	23.1	31	26.1	24	22.2	82	23.8	
Breastfeeding									
Exclusive	55	47.0	58	48.7	49	45.4	162	47.1	0.879
Non exclusive	62	53.0	61	51.3	59	54.6	182	52.9	
Complementary feeding (months)									
≥6	84	71.8	93	78.2	77	71.3	254	73.8	0.415
<6	33	28.2	26	21.8	31	28.7	90	26.2	
Immunization									
Complete	66	56.4	52	43.7	51	47.2	169	49.1	0.132
Incomplete	51	43.6	67	56.3	57	52.8	175	50.9	

*Chi-square; MLP: *Moringa* leaves powder; IFA: Iron folic acid; MLE: *Moringa* leaves extract

Socioeconomic characteristics of family

The results of statistical analysis show that there are no significant differences in mother's and father's education, mother's and father's occupation, and monthly family income between the three study groups ($p > 0.05$). Table 3 illustrates that the three research groups have similarities in terms of your education, your work, and monthly family income.

Table 3: Socioeconomic characteristics of family in Jeneponto Regency, 2019

Variables	MLP (n=117)		IFA (n=119)		MLE (n=108)		Total (n=344)		p*
	n	%	n	%	n	%	n	%	
Mother's education (years)									
≥12	38	32.5	35	29.4	32	29.6	105	30.5	0.852
<12	79	67.5	84	70.6	76	70.4	239	69.5	
Father's education (years)									
≥12	45	38.5	36	30.3	30	27.8	111	32.3	0.195
<12	72	61.5	83	69.7	78	72.2	233	67.7	
Mother's occupation									
Employed	26	22.2	25	21.0	19	17.6	70	20.3	0.673
Unemployed	91	77.8	94	79.0	89	82.4	274	79.7	
Father's occupation									
Farmers + Fishermen	50	42.7	53	44.5	46	42.6	149	43.3	0.395
Civil servants/private	14	12.0	18	15.1	20	18.5	52	15.1	
Driver/labor	36	30.8	24	20.2	27	25.0	87	25.3	
Entrepreneur	14	12.0	22	18.5	11	10.2	47	13.7	
Others	3	2.6	2	1.7	4	3.7	9	2.6	
Family income (million/mo)									
≥2	29	24.8	32	26.9	31	28.7	92	26.7	0.802
<2	88	75.2	87	73.1	77	71.3	252	73.3	

*Chi-square; MLP: *Moringa* leaves powder; IFA: Iron folic acid; MLE: *Moringa* leaves extract

Social-personal development of children aged 18–23 months

Table 4 shows that there are 107 children (91.5%) with normal social-personal development in the *Moringa* leaves powder (MLP) group; this number is more than the children in the IFA group which are 103 children (86.6%) and the *Moringa* leaves extract (MLE) group which are 95 children (88.0%).

Table 4: Social-personal development of children aged 18–23 months between MLP, IFA, and MLE groups in Jeneponto Regency, 2019

Child's social-personal	MLP		IFA		MLE		Total		p-value
	n	%	n	%	n	%	n	%	
Social-personal									
Normal	107	91.5	103	86.6	95	88.0	305	88.7	0.476
Suspect	10	8.5	16	13.4	13	12.0	39	11.3	

*Chi-square; MLP: *Moringa* leaves powder; IFA: Iron folic acid; MLE: *Moringa* leaves extract

The differences are also seen in the social development of suspect children. It turns out that the number of children with suspect development in the IFA group is more than those who are suspect in the MLP group or the MLE group.

It shows that social-personal development in children from the MLP and MLE groups has a better tendency than children from the IFA group. Although the results of statistical tests showed that there was no significant difference [Figure 1], the MLP and MLE groups were empirically more likely to be better than the IFA group.

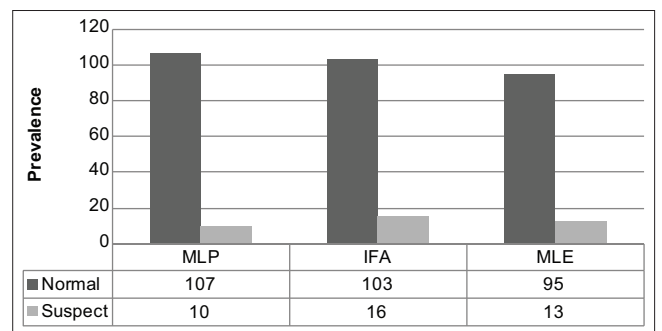


Figure 1: Social-personal development children aged 18–23 months between the *Moringa* leaves powder, iron folic acid, and *Moringa* leaves extract groups in Jeneponto Regency, 2019

Discussion

The results showed that social-personal development of the children from the MLP and MLE groups tended to be better than the children from the IFA group; although the results of statistical tests showed no significant difference ($p > 0.05$).

The results of the study using prescreening developmental questionnaire found that of 321 subjects aged 1–2 years, there were 278 children (90.22%) who experienced normal development and 30 children (9.78%) experienced suspect development [8]. If

children who experience these developmental disorders are not handled properly, the majority of them (89%) will experience failure in their schools. In developing countries, including Indonesia, environmental factors that can cause child developmental disorders are generally caused by poverty and people's ignorance of the process of growth and development [9].

A research on the development of toddlers aged 7–24 months between children who were given exclusive and non-exclusive breastfeeding in Ngawi District found that the social-personal development of children who received exclusive breastfeeding was better than children who did not receive exclusive breastfeeding [10]. The content of zinc in breast milk is needed for growth and development, the immune system and the prevention of certain diseases in infants. Growth and development can work with the help of exclusive breastfeeding such as gross motor skills, fine motor skills, speech and language skills, as well as the ability to socialize and being independent [11].

There is 5.20 mg of zinc in 100 mg of *Moringa* flour consumed by breastfeeding mothers which is expected to have an effect on the content of breast milk. Zinc is an important mineral for children's growth and development. Zinc minerals play a role in protein synthesis, adenosine dinucleoside (DNA), and adenosine ribonucleoside (RNA) and play a role in the work of enzymes in the body. Zinc deficiency will be fatal, especially in the development of brain structure, brain function, and interfere with behavioral and emotional responses. *Moringa* supports brain health and cognitive function with antioxidant and neuroenhancer activities. *Moringa* leaf powder has a positive effect on the prevention and control of malnutrition in infants, pregnant women, and breastfeeding mothers [12].

At the age of 1–2 years, most children still receive total attention from their mothers regarding their food, breast milk, and adequate development stimulation. Giving total breast milk will strengthen the mental relationship between mother and child that is very beneficial for further development of mental and emotional of the children [13].

The growth and development disorders of children can occur within a period of growth and development processes that take place from intrauterine to adulthood. Influencing factors include genetic, environmental, and disease factors experienced by children. Early detection and appropriate interventions can optimize the quality of subsequent child development [14].

One of the appropriate intervention efforts to improve the nutrition of pregnant women and breastfeeding mothers which ultimately maximizes the growth and development of children is to utilize local potential. One of the many local potential available in South Sulawesi is *Moringa* leaves. *Moringa* leaves are the food that is rich in macro- and micro-nutrients. The

high nutritional value in the *Moringa* leaves can be used to meet the nutritional needs of breastfeeding mothers and toddlers in their infancy [15].

Children's development patterns can be disrupted not only from environmental or physical conditions in the form of nutritional deficiencies whether temporary or permanent, but the developmental disorders can be in the form of illness, seasons, or severe emotional tension [16].

Not all children experience normal social-personal development. It can be caused partly by the mother's age, educational background, type of work and family income per month, cultural values, lifestyle, social, and family values [17].

The responsibility of parenting especially mothers in providing stimulation is based on the knowledge that is owned by the mother, but the knowledge and skills possessed by the mother are frequently inadequate. It can be due to mother's education level.

One of the factors that can affect a child's social-personal disorders in this study is the level of parents' education. Most parents have education <12 years. Someone with a high level of education has more knowledge. Knowledge obtained from the education is applied in everyday life, especially in the provision of stimulation to the children. Parents can receive all information about how to take care of the children well with stimulation, and how to maintain the health of their children. Lack of education will interfere the development of someone's attitude toward newly introduced values, which causes mothers to be unable to provide stimulatory measures optimally [18].

Some experts associate the causes of developmental disorders of children against the background of poverty; it is related to family income. In this study, the monthly family income was < IDR 2,000,000 which means the family's economic status was low. Type of work and income per month is the two factors that can affect the provision of stimulation.

Factors of poverty and life pressure can cause a person to easily emit emotions to those around him/her, including children. Work factors related to economic conditions are closely related to the cause of parents doing verbal abuse due to the increasing number of crises in their lives. It causes the non-optimal stimulation of children [19].

Another factor causing suspect of the child's social-personal development in this study was the age of the parents. The majority of them were middle-aged adults, 20–35 years, who had considerable developmental tasks, just started working, learned to live with their husband or wife, started having new families, taking care of children, and managing households. Parents should continue to accompany the children at each stage of their growth and development, and train their social-personal development by introducing them

to new activities such as playing with other children, showing affection for toys, other children, siblings or pets. Parents should ensure that children do it in their own way with parental supervision. Stimulation given by parents is related to the child's behavior, mediated by positive parenting practices [20].

During the children's development, social support from family members is an important factor that can encourage them to behave positively. The better the stimulation a parent gives to a child, the better the child's social-personal development.

Conclusion

We concluded that there was no significant difference in the children's social-personal development between the three study groups.

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