

Nutrition Education and Psychosocial Stimulation Improves Child Development in Rural Early Childhood Education in Indonesia

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Abstract Early childhood education (*Pendidikan Anak Usia Dini* - PAUD) in Indonesia is an educational effort intended to preschool-aged children through stimulation to support children's growth and development. The aim of this study was to investigate the effects of nutrition and psychosocial stimulation to the child development in rural PAUD. A quasi-experimental design consisted baseline and end-line data collections of control (baseline: n=68; end-line: n=61) and intervention (baseline: n=69; end-line: n=63) groups of children under five years and their mothers were investigated for 12 months following the nutrition education and psychosocial stimulation. In addition, the investigation also carried out to the teachers at PAUDs. The study was conducted at 6 PAUDs in Dramaga Sub-district (control) and 4 PAUDs in Tamansari Sub-district (intervention) in the City of Bogor, West Java, Indonesia. The outcomes included characteristics of study participants, mothers' nutritional knowledge-attitude-practice, mothers' and teachers' psychosocial stimulation knowledge and practice, children's nutritional status and development. Nutrition education increase mothers' nutritional knowledge score of 4.7 points ($p < 0.01$). Child development score was greater in intervention group ($p < 0.001$). The intervention could withstand the decline in body mass index for age z-scores (BAZ) ($p = 0.017$). The intervention improves mothers' nutritional knowledge and practice, mothers' and teacher's psychosocial knowledge and practice, and child development. The intervention can be successfully implemented by mothers and teachers in rural PAUD.

Keywords: *child development, early childhood education, nutrition education, preschool-aged children, psychosocial stimulation*

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1. Introduction

In Indonesia, Early Childhood Education or called as 'PAUD' (*Pendidikan Anak Usia Dini*) provides stimulation on children's growth and development. Early child development (ECD) typically refers to early childhood with a strong focus on the first 2-3 years of life and describes the gradual unfolding of children's sensory-motor, cognitive-language, and social-emotional capacities shaped by interactions between the environment, experiences, and genetics [1]. Mandleco [2] classifies preschool or early childhood children as children in the age range of three to six years. Children aged 3-6 years are

preschool ages which are happy and very satisfying times of all children's lives. A study by Miller and Kehl [3] indicates that teachers and parents agreed upon the relative importance of early school readiness components that is being healthy, happy, and socially skilled were generally ranked as more important than cognitive abilities in the preschool aged child.

Moreover, the early provision of optimal nutrition and opportunities for learning (supported by responsive caregiving behaviours that are prompt, contingent on children's actions, and developmentally appropriate and stimulating) have been linked to positive ECD outcomes [4]. There is a clear evidence from the sciences of brain and child development that interventions in early childhood development and education can have a

substantial benevolent and lasting effect throughout the life course of children and families [5].

Increased intelligence, supported by optimum health and nutrition will improve ability of a child to achieve physical and spiritual development so that children have readiness to enter further education. It is estimated that 250 million children under 5 years of age in low- and middle-income countries are at risk of not reaching their developmental potential. There is an urgent need to increase multisectoral coverage of quality programming incorporating health, nutrition, security and safety, responsive caregiving, and early learning which are crucial for meeting Sustainable Development Goals, and for children to develop the intellectual skills, creativity, and wellbeing required to become healthy and productive adults [6].

Previously Grantham-MacGregor et al. [7] stated that the inhibition in children developmental potential is due to challenges from undernutrition, poor health, environmental toxins, and lack of stable, loving, and responsive care, and, further, that the basic rights to health, development, and protection for over one-third of the world's children under five are not being realized [8]. Such problems are also experienced by children in Indonesia.

The prevalence of children who experienced a growth disorder (stunting) is still high enough, that is 30.8% [9]. Nutritional problems which are now faced by Indonesia are likely due to the low purchasing power of the people. The Lancet series on maternal and child nutrition reported that a substantial reduction in the burden of undernutrition could be achieved if low-income populations had access to 10 evidence-based nutrition-specific interventions [10]. The nutrition-sensitive interventions that draw on complementary sectors such as agriculture, social safety nets, early child development, and schooling to affect the underlying determinants of poor nutrition, including limited access to healthy foods and lack of adequate care [11].

The newest concept proposed by Martorell [12] state that nutrition deficiency may cause children weak and quiet, and this makes the children unable to explore the world optimally and they do not grow up and this leads to delayed development. In populations where poverty and food insecurity is high (resulting in micronutrient deficiencies, stunting, and wasting), the points of integration may not only include common caregiving competencies and knowledge on nutrition and ECD but may also necessitate nutritional supplements [13]. In addition, similar to nutrition-sensitive approaches, supporting the broader capacity of the family to provide optimal care for their young children is likely to benefit early child development [14].

Psychosocial stimulation is a way of training children in order to develop their mental and psychomotor ability. The promotion of healthy dietary patterns and feeding behaviors and the success of these interventions require the implementation of social and behavior change communication strategies that target behavior changes among those who directly (parents) or indirectly (family and community members) influence child nutrition outcomes [15]. One form of parents' attentions in their children's life is parenting. Anwar [16] proved that children of 12-18 months old who got psychosocial intervention and food supplements showed a better development in terms of Mental Development Index,

Psychomotor Development Index, and Behavioral Aspect. Moreover, study by Khomsan et al. [17] pointed out that the cognitive development of the children who became students of PAUD was higher than that of the children who were not enrolled in PAUD. International evidence shows that early intervention to children can be used as a way to reduce the negative effects of poverty towards the outcomes of short and long-term education and health [18].

In regard with the great number of preschool-aged children who are still lack opportunities to get a qualified program of growth and development, growth and development intervention is essential to be implemented among them. Aim of this study was to investigate the effects of nutrition and psychosocial stimulation to the child development in rural PAUD. Thus, the hypothesis of this study is that nutrition and psychosocial stimulation may improve child development in rural PAUD.

2. Materials and Methods

2.1. Study Design and Participants

The study design was a quasi-experimental design consisted of baseline and end-line data collections of control and intervention groups. The study was conducted in PAUD (early childhood education) institutions located in two Sub-districts of Bogor: 6 PAUDs in Dramaga Sub-district (control) and 4 PAUDs in Tamansari Sub-district (intervention) for 12 months. Participants were children under five with their mothers and teachers from selected PAUDs.

This study was intended to measure the impact of nutrition education and psychosocial stimulation on children growth and development. Based on study by Nahar et al. [19], it was determined that Home Observation for Measurement of Environment/HOME score of children who received psychosocial intervention and complementary feeding was 89.1 ± 6.6 , while HOME score of children in control group was 85.3 ± 7.0 . Using confidence interval of 95% and power of 80%, the minimum number of samples was 54 and added by 10% to anticipate drop-out to be at least 60 children in intervention group. In the control group, sixty-eight ($n = 68$) children with their mothers participated at the baseline and sixty-one ($n = 61$) completed the study. In the intervention group, sixty-nine ($n = 69$) children with their mothers participated at the baseline and sixty-three ($n = 63$) follow the intervention and completed the study. Nineteen ($n = 19$) teachers participated in the control group, while thirteen ($n = 13$) teachers participated in the intervention group and 12 of them completed the study.

The study protocol was approved by the Commission on Health Research Ethics Faculty of Public Health Diponegoro University (protocol no. 83/EC/FKM/2017). Written informed consent was obtained from all study participants prior to enrolling the study. Participant's anonymity was preserved.

2.2. Data Collection

Data collection consists of characteristics of study participants, mothers' nutritional knowledge-attitude-practice,

mothers' and teachers' psychosocial stimulation knowledge and practice, children's nutritional status and development. Methods of data collection was based on interview using questionnaires, observation, and direct anthropometric measurement. The instrument tryout was conducted to determine the quality and consistency of the instrument. The validity and reliability index (Cronbach Alpha) of instrument items were at 0.565 and 0.601 for nutritional knowledge and attitude, 0.716 and 0.762 for psychosocial stimulation knowledge and practice, and 0.850 for child development.

2.2.1. Characteristics of Study Participants

Data were collected at the baseline by interview using a questionnaire including children's age and gender; household socioeconomics and demographics (parents' age, education level, family size, number of children, income, and expenditure); and teachers' age and length of teaching experience.

2.2.2. Mothers' Nutritional Knowledge, Attitude, and Practice

Pre- and post-test of the nutritional aspects were carried out to the mothers at the baseline and end-line. Nutritional aspects consisted of statement items on basic nutrition, nutrition for children under five, basic sanitation and hygiene, and food safety. Nutritional knowledge consisted of 15 items with response options "True" and "False", nutritional attitude consisted of 15 items with response options "Agree" and "Disagree", while nutritional practice consisted of 14 items with response options "Yes" and "No".

2.2.3. Mothers and Teachers' Psychosocial Stimulation Knowledge and Practice

Knowledge on the characteristics of child development, stimulation techniques, and the way to monitor child development were identified by interview using a questionnaire to the mothers and teachers at the baseline and end-line. The psychosocial stimulation knowledge instrument consists of 20 statement items with response options "True" and "False". Mothers' psychosocial stimulation practice was recorded at the baseline and end-line by interview and observation using a permitted HOME inventory questionnaire from Caldwell and Bradley [20] consisting of 55 statement items covering: learning material, language stimulation, physical environment, responsivity, academic stimulation, modelling, variety, and acceptance.

Teachers' psychosocial stimulation practice was recorded by interview and observation using a tool according to the Regulation of the Ministry of Education and Culture of the Republic Indonesia Number 137 of 2014 concerning the National Standard for Early Childhood Education [21]. The number of statement items is 20 with response options "Never", "Sometimes", and "Always".

2.2.4. Children's Nutritional Status and Development

Children's nutritional status was observed at the baseline and end-line by measuring weight (kg) and height (cm). The nutritional status was calculated from the anthropometric index based on WHO [22], that is, z-score

of weight for age (WAZ), height for age (HAZ), weight for height (WHZ), and body mass index for age (BAZ).

Child development was measured using a Toddler Family Development instrument from BKKBN (*Badan Koordinasi Keluarga Berencana Nasional* - National Population and Family Planning Board) for 3-4 years and 4-5 years [23]. Child development consists of gross movement, fine movement, understanding gestures and conversation, expressing with gestures, intelligence, self-help, and interacting with others, its measured by using tools, such as educational games, stationery, books, and others. The development of gross and fine (motor) movements involve most parts of the body and requires energy since it is done by larger muscles, while fine movements, that involve only certain body parts, are carried out by small muscles and do not require energy. Passive communication is the ability to understand and do what is ordered by others, while active communication is the ability to speak. Development of intelligence (cognitive) covers concept or understanding ranging from recognizing color, sound, taste, name to more abstract and plural concepts. Development of self-assistance and social behavior means that children need to have friends, extensive associates, need to be taught disciplines, courtesy, and so on in order not to be awkward in entering new environments [24].

2.3. Intervention Study

The intervention activities (nutrition education and psychosocial stimulation) were carried out within 12 months. Researchers monitored and provided technical assistantship to participants (mothers and teachers in PAUDs). In each session, participants received one material and took a pre- and post-test. The researchers prepared education materials such as modules and leaflets. Nutrition education material including basic nutrition, nutrition for children under five, basic sanitation and hygiene, and food safety; psychosocial intervention material including knowledge on the characteristics, stimulation technique, and monitoring of early-aged child development.

2.4. Statistical Analysis

Data are expressed as mean \pm SD and frequency (%). Statistical analysis was performed with the independent *t*-test for delta mean between control and intervention groups. Statistical analysis for baseline and end-line data in each group was performed by Paired *t*-test. Prior to analysis, scores from variables were converted into indexes (0.0-100.0), then categorized into poor (<60), moderate (60-80), and good (>80). Mothers' psychosocial stimulation practice (HOME) was classified by median score [24], so its categories consist of poor (score < median) and good (score \geq median).

3. Results

Characteristics of study participants are presented in Table 1. Household social economic levels were categorized as low due to their education and income

levels. Regarding the teachers' characteristic, the experience of teachers was not sufficient enough to promote child development in early childhood education. In Table 2, at the baseline more than half of mothers in the control group had good category of nutritional knowledge and attitude (55.9% and 58.8%), while in the intervention group, less than half mothers had good nutritional knowledge and attitude (36.2% and 46.4%). A significant increase of nutritional knowledge was found in the intervention group by 4.7 points ($p=0.003$).

The distribution and score of mothers' knowledges on psychosocial stimulation is presented in Table 3. The increase in mothers' psychosocial stimulation knowledge at the end-line occurred in the intervention group by 3.3 points ($p=0.041$) with the percentage of mothers with good knowledge being 60.3%, whereas in the control group there was a decrease in the mean score of knowledge by -4.5 points. Mothers' psychosocial

stimulation knowledge was significantly different between groups ($p=0.004$). At the end-line, 52.4% of mothers in the intervention group belonged to the good category on their psychosocial stimulation practice, while 50.8% of mothers in the control group belonged to the poor category. The score was increased significantly ($p<0.001$) after the intervention compared to the control.

In Table 4, teachers' psychosocial stimulation knowledge was increased by 17.9 points after the intervention ($p=0.001$), while there is no significant change in the control group with a decrease score by -3.7 points. Scores of teachers' psychosocial stimulation knowledge was different significantly between groups ($p<0.001$).

There is no significant change on mean score of teachers' psychosocial stimulation practice between control and intervention groups. However, psychosocial stimulation practice score was increased significantly in the intervention group at the end-line ($p=0.044$).

Table 1. Characteristics of Study Participants

Characteristics	Control		Intervention	
	Baseline (n=68)	End-line (n=61)	Baseline (n=69)	End-line (n=63)
Children				
Age (months)	56.1 ± 7.7	67.5 ± 7.8	59.0 ± 5.5	70.2 ± 5.7
Gender, n (%)				
Male	38 (55.9)	33 (54.1)	28 (40.6)	25 (39.7)
Female	30 (44.1)	28 (45.9)	41 (59.4)	38 (60.3)
Households		(n = 68)		(n = 69)
Age (years)				
Father	35.6 ± 6.5 ^a		33.1 ± 8.5 ^a	
Mother	31.1 ± 6.0 ^a		28.2 ± 5.2 ^b	
Education level (years)				
Father	10.3 ± 2.4 ^a		7.9 ± 2.8 ^b	
Mother	10.4 ± 2.6 ^a		8.2 ± 2.8 ^b	
Family size (persons)	4.4 ± 1.3 ^a		4.2 ± 1.3 ^a	
Number of children (persons)	1.8 ± 0.8 ^a		1.5 ± 0.6 ^b	
Income (IDR/cap/month)	821,097 ± 446,009 ^a		739,532 ± 394,160 ^a	
Expenditure (IDR/cap/month)	834,886 ± 233,558 ^a		773,671 ± 217,950 ^a	
Teachers		(n = 19)		(n = 13)
Age (years)	35.4 ± 10.0		33.8 ± 9.4	
Length of teaching experience (years)	3.4 ± 3.1		6.4 ± 3.4	

Data were expressed as Mean ± SD, except for children's gender. Different letters on the same row shows the significance level ($p<0.05$) based on *t*-test. IDR: Indonesian Rupiah

Table 2. Mothers' Nutritional Knowledge-Attitude-Practice

Category	Control			Intervention		
	Baseline (n=68)	End-line (n=61)	p	Baseline (n=69)	End-line (n=63)	p
Nutritional knowledge, n (%)						
Poor (< 60)	0 (0.0)	3 (4.9)	-	1 (1.4)	0 (0.0)	-
Moderate (60-80)	30 (44.1)	30 (49.2)	-	43 (62.3)	30 (47.6)	-
Good (> 80)	38 (55.9)	28 (45.9)	-	25 (36.2)	33 (52.4)	-
Mean ± SD (index)	82.0 ± 9.0	78.9 ± 12.9	0.099	78.2 ± 11.6	82.9 ± 10.9	0.003
Δ Mean		-3.1 ± 14.3	-		4.7 ± 11.9	0.001
Nutritional attitude, n (%)						
Poor (< 60)	1 (1.5)	3 (4.9)	-	2 (2.9)	0 (0.0)	-
Moderate (60-80)	27 (39.7)	27 (44.3)	-	35 (50.7)	31 (49.2)	-
Good (> 80)	40 (58.8)	31 (50.8)	-	32 (46.4)	32 (50.8)	-
Mean ± SD (index)	82.6 ± 11.3	81.6 ± 12.6	0.519	80.8 ± 12.3	81.7 ± 11.3	0.573
Δ Mean		-1.0 ± 11.9	-		1.0 ± 13.3	0.394
Nutritional practice, n (%)						
Poor (< 60)	4 (5.9)	1 (4.6)	-	15 (21.7)	3 (4.8)	-
Moderate (60-80)	49 (72.1)	24 (39.3)	-	45 (65.2)	33 (52.4)	-
Good (> 80)	15 (22.1)	36 (59.0)	-	9 (13.0)	27 (42.9)	-
Mean ± SD (index)	74.8 ± 10.2	83.9 ± 10.1	0.0001	67.8 ± 13.1	79.0 ± 11.5	0.0001
Δ Mean		9.1 ± 11.0	-		11.2 ± 12.4	0.323

p-values are based on *t*-test within groups and delta (Δ) values between groups.

Table 3. Mothers' Psychosocial Stimulation Knowledge and Practice

Category	Control		p	Intervention		p
	Baseline (n=68)	End-line (n=61)		Baseline (n=69)	End-line (n=63)	
Psychosocial stimulation knowledge, n (%)						
Poor (< 60)	4 (5.9)	8 (13.1)	-	7 (10.1)	1 (1.6)	-
Moderate (60-80)	21 (30.9)	19 (31.1)	-	26 (37.7)	24 (38.1)	-
Good (> 80)	43 (63.2)	34 (55.7)	-	36 (52.2)	38 (60.3)	-
Mean ± SD (index)	84.7 ± 12.9	80.2 ± 16.1	0.041	81.1 ± 14.4	84.4 ± 12.2	0.046
Δ Mean	-4.5 ± 16.8		-	3.3 ± 12.9		0.004
Psychosocial stimulation practice, n (%)						
Poor (score < median)	21 (30.9)	31 (50.8)	-	39 (56.5)	30 (47.6)	-
Good (score ≥ median)	47 (69.1)	30 (49.2)	-	30 (43.5)	33 (52.4)	-
Mean ± SD (index)	41.9 ± 5.5	40.9 ± 3.8	0.179	38.3 ± 5.5	41.1 ± 4.2	0.0001
Δ Mean	-1.0 ± 5.8		-	2.8 ± 4.8		0.0001

p-values are based on *t*-test within groups and delta (Δ) values between groups.

Table 4. Teachers' Psychosocial Stimulation Knowledge and Practice

Category	Control		p	Intervention		p
	Baseline (n = 19)	End-line (n = 19)		Baseline (n = 13)	End-line (n = 12)	
Psychosocial stimulation knowledge, n (%)						
Poor (< 60)	0 (0.0)	0 (0.0)	-	0 (0.0)	0 (0.0)	-
Moderate (60-80)	0 (0.0)	1 (5.3)	-	10 (76.9)	0 (0.0)	-
Good (> 80)	19 (100.0)	18 (94.7)	-	3 (23.1)	12 (100.0)	-
Mean ± SD (index)	99.2 ± 1.9	95.5 ± 7.8	0.069	79.6 ± 9.6	97.5 ± 3.9	0.001
Δ Mean	-3.7 ± 8.3		-	17.9 ± 13.4		0.0001
Psychosocial stimulation practice, n (%)						
Poor (< 60)	0 (0.0)	0 (0.0)	-	0 (0.0)	0 (0.0)	-
Moderate (60-80)	1 (5.3)	0 (0.0)	-	0 (0.0)	2 (16.7)	-
Good (> 80)	18 (94.7)	19 (100.0)	-	13 (100.0)	10 (83.3)	-
Mean ± SD (index)	96.6 ± 6.3	97.5 ± 2.5	0.509	87.7 ± 1.9	93.7 ± 8.9	0.044

p-values are based on *t*-test within groups and delta (Δ) values between groups.

Table 5. Children's Weight, Height, and BAZ Nutritional Status

Category	Control		p	Intervention		p
	Baseline (n = 68)	End-line (n = 61)		Baseline (n = 69)	End-line (n = 63)	
Weight (kg)	16.8 ± 3.7	18.1 ± 4.2	0.0001 ^a	15.9 ± 2.1	17.2 ± 2.9	0.0001 ^a
Height (cm)	103.3 ± 5.9	109.1 ± 5.2	0.001 ^a	102.4 ± 4.9	106.6 ± 4.5	0.001 ^a
BAZ, n (%)						
Severe thinness	0 (0)	1 (1.6)	-	1 (1.4)	1 (1.6)	-
Moderate thinness	1 (1.5)	5 (8.2)	-	1 (1.4)	1 (1.6)	-
Normal	55 (80.9)	45 (73.8)	-	57 (82.6)	53 (84.1)	-
Overweight	6 (8.8)	4 (6.6)	-	8 (11.6)	6 (9.5)	-
Obese	6 (8.8)	6 (9.8)	-	2 (2.9)	2 (3.2)	-
BAZ, Mean ± SD	0.1 ± 1.4	-0.4 ± 1.6	0.0001 ^a	-0.2 ± 1.1	-0.3 ± 1.3	0.503 ^a
Δ Mean	-0.5 ± 0.9		-	-0.1 ± 1.0		0.017 ^b

Weight and height were expressed as Mean ± SD; BAZ, body mass index for age z-scores were expressed as (n, %) and Mean ± SD. ^ap-values are based on paired *t*-test within groups, ^bp-values are based on *t*-test between groups. BAZ: severe thinness (BAZ < -3.0), moderate thinness (-3.0 ≤ BAZ < -2.0), normal (-2.0 ≤ BAZ ≤ 1.0), overweight (1.0 < BAZ ≤ 2.0), and obese (BAZ > 2.0).

Table 6. Scores of Child Development Outcomes

Child development	Control		p	Intervention		p
	Baseline (n = 68)	End-line (n = 61)		Baseline (n = 69)	End-line (n = 63)	
Category, n (%)						
Poor (< 60)	2 (2.9)	0 (0.0)	-	0 (0.0)	0 (0.0)	-
Moderate (60-80)	8 (11.8)	1 (1.6)	-	14 (20.3)	0 (0.0)	-
Good (> 80)	58 (85.3)	60 (98.4)	-	55 (79.7)	63 (91.3)	-
Mean ± SD (index)	91.8 ± 11.7	96.5 ± 4.7	0.040	86.4 ± 8.9	98.7 ± 2.5	0.006
Δ Mean	4.7 ± 11.5		-	12.3 ± 8.4		0.0001
Gross movement	95.3 ± 11.6	99.4 ± 2.7	0.006	94.7 ± 12.9	100.0 ± 0.0	0.001
Fine movement	87.9 ± 17.2	97.2 ± 8.7	0.001	92.2 ± 13.5	99.2 ± 3.6	0.0001
Understanding gestures and conversation	89.9 ± 17.5	99.0 ± 3.0	0.0001	84.3 ± 16.9	99.2 ± 3.3	0.0001
Expressing with gestures	91.3 ± 16.7	92.1 ± 13.9	0.875	75.9 ± 20.0	98.1 ± 5.6	0.0001
Intelligence	89.7 ± 17.4	98.1 ± 5.8	0.0001	89.3 ± 13.5	99.4 ± 3.7	0.0001
Self-help	89.2 ± 12.4	91.2 ± 14.3	0.437	90.9 ± 12.1	94.4 ± 10.5	0.049
Interacting with others	95.3 ± 14.1	97.0 ± 9.8	0.411	89.4 ± 17.8	98.9 ± 6.6	0.0001

p-values are based on *t*-test within groups and delta (Δ) values between groups.

Table 5 shows anthropometric parameters (weight and height) and nutritional status of children (BAZ). At the end-line, mean of weight increases by 1.3 kg in both groups ($p < 0.001$), while mean of height increases by 5.8 cm and 4.2 cm in control and intervention group, respectively. Mean of height in the intervention group was 0.9 centimeters lower than that of control group. The nutritional status of children (BAZ) was found to be significantly different between groups ($p = 0.017$). BAZ nutritional status became worse in the control group when compared to the intervention group. There was a large proportion of children who had overweight and obesity at the baseline, that is, 17.6% and 14.5% of the children in the control and intervention groups, respectively. This proportion decreased slightly at the end-line. There is no impact from the intervention toward the change in the WAZ, HAZ, and WHZ nutritional status.

Table 6 presents the distribution and average scores of child development outcomes. Baseline achievement score of child development in the control group (91.8) was higher compared to the intervention group (86.4). After the intervention, mean achievement of child development was increased significantly ($p = 0.006$) and the score was higher than control (98.7 versus 96.5). Child development scores was significantly different between control and intervention groups ($p < 0.001$). Both groups have experienced an increase in the percentage of children by their development category. At the baseline, almost all of the children in the intervention group were able to perform the movement which were measured. After the intervention, most of child development outcomes were improved significantly ($p \leq 0.001$), so as in the control group with the exception of the development outcomes including expressing with gestures, self-help, and interacting with others. The improvement scores of child development in the intervention group was greater than in the control group (11.5 versus 5.2 points).

4. Discussion

Nutrition education was done in order to improve mothers' nutritional knowledge. Mothers in the village (rural areas) have difficulty to access the nutrition information since most Community-based Integrated Care Units that provide monthly health and nutrition services are more focused on the weighing of children under five and vaccination/immunization services. The nutritional education is rarely administered, so that our nutrition education gained more attention and enthusiasm from the participating mothers. Nutrition education has been able to improve mothers' nutritional knowledge. Nutrition education and psychosocial stimulation have no impact on nutritional status of the children. Prior to the study, there were some children who were underweight, stunted, and overweight or obese with the percentages of children ranging between 10-20%.

Intervention for parents and PAUD teachers has a strategic meaning because they are people closest to early childhood. Psychosocial stimulation is a part of quality care practices carried out by parents that aims to ensure the survival and development of children [25]. By the present study, the increase in mother's psychosocial

stimulation knowledge in the intervention group may have a positive impact on child development. Studies by Leibowitz [26] and Hartoyo [27] showed the importance of the family role in improving individual quality through investment done by parents to their children. Parents are motivated to make an investment for their children through their resources in the hope that their children will be more successful in the future [28]. Therefore, parents' role affects very much the establishment of their children's personality, ability, growth and development. According to Reich [29], mothers' knowledge in child care and development is influenced by maternal characteristics such as education and age and household characteristics such as family size and per capita income. Huang et al. [30] mentioned that mothers who have better knowledge make it possible to create an appropriate environment to support child development. Additionally, Aboud et al [31] reviewed interventions conducted since 2000 and found that psychosocial-stimulation interventions ($n = 21$) had a medium-effect size of $d = 0.43$ on children's cognitive development and that nutrition supplementation and education interventions ($n = 18$), had a small-effect size of $d = 0.09$.

Our study found the improvement in the level of knowledge and practice of psychosocial stimulation between before and after intervention. According to Zepeda et al. [32], parents gained knowledge and skills in stimulating child development through ethnic and cultural inheritance, kinship networks, friendships, communities, and resources. The level of knowledge possessed by parents was related to the expectations of achieving child development, the environment of nurturing, stimulating and providing means to optimize child development according to his age [29,33], and good parenting knowledge that involve experience, expertise, quality and responsibility play an important role to optimize it [34].

Mothers' and teachers' knowledge of psychosocial stimulation for early childhood is important to help to select and determine the type of stimulation for the children to support the achievement of child development. Although the overall achievement of stimulation has been practiced by the teachers with a good score in both groups, some stimulation practices still need to be improved including teaching children simple worship practices, teaching children to throw, catch, kick the ball, enrich vocabulary, train children to express verbal feelings, training in making lines, curves, tilted, and circle, teaching children to draw using various media. The average achievement of child development was improved after the intervention which had an impact on the increase in intelligence and psychomotor development of children. The development of intelligence is related to the ability to capture, think power, memorize and solve problems [23,24].

Early childhood development approaches are based on the fact that children respond best when caregivers (parents and teachers) use specific techniques designed to push and stimulate progress towards the next level of development [35]. Moreover, early childhood is a critical age to speculate, explore, play, and be creative without fear of failing to test ideas, learn to solve problems, expand trust in adulthood, and build relationships with people of the same age. During this time, the attention

span is expanded and children increases their knowledge [36].

Psychosocial stimulation provided to the children can be in the form of providing educational games, parental involvement in teaching objects, teaching good behavior, giving love, warmth, a safe and comfortable environment, involving children in active and passive communication effectively, and being a good role model for children. To improve the quality of early childhood education, teachers may also need to improve their skills in developing learning plans that can optimize the stimulation of child development. In addition, knowledge about children's growth and development for parents, teachers, and professionals should be well understood [37]. In line with that, the present study provided a beneficial effect in accordance with the improvement of mothers' nutritional knowledge, mothers' and teachers' psychosocial knowledge and practice, and child development.

5. Conclusions

The study concluded that nutrition education and psychosocial stimulation improves mothers' nutritional knowledge and practice, mothers' and teachers' psychosocial knowledge and practice, and child development. We may suggest that nutrition education and psychosocial stimulation may become key factors to promote better achievement on child development in rural early childhood education. The intervention could withstand the decline of child BAZ. The study had some limitations that the design was quasi-experimental study which weaker than randomized-controlled trial. Moreover, the education level of the mothers in the control group was found higher than that of mothers in the intervention group which might affect to the results on mothers' nutritional knowledge. Further study is required to determine the longer effect of extended intervention on children' growth and development.

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Statement of Competing Interest

The author(s) declared have no competing interest.

References

- [1] Yousafzai, A.K., Bhutta, Z.A., Integrating early child development interventions in child health services: opportunities and challenges in developing countries. In: Kamat D, editor, American Academy of Pediatrics Textbook of Global Child Health, 1st edition, American Academy of Pediatrics, Washington (DC), 2012.
- [2] Mandlco, B.L, *Growth and Development Handbook: Newborn through Adolescent*, Thomson Delmar Learning, New York, 2004.
- [3] Miller, M.M. and Kehl, L.M., "Comparing parents' and teachers' rank ordered importance of early school readiness characteristics", *Early Childhood Education Journal*, 47 (4), 445-453, July 2019.
- [4] Black, M.M., Dewey, K.G., "Promoting equity through integrated early child development and nutrition interventions", *Ann N Y Acad Sci* 1308, 2014, 1-10.
- [5] Tarlov, A.R., Children Develop in an Environment of Relationships, In: *Investing in Early Childhood Development. Evidence to Support a Movement for Educational Change*, Tarlov, A.R., Debbink, M.P. (eds), MacMillan, New York, 2008, 27-40.
- [6] Black, M.M., Walker, S.P., Fernald, L.C., et al, "Early childhood development coming of age: Science through the life course", *Lancet* 389 (10064), 77-90, January 2017.
- [7] Grantham-MacGregor, S., Cheung, Y.B., Cueto, S., Glewwe, P., Richter, L., Strupp, B., et al, "Developmental Potential in the first 5 years for children in developing countries", *Lancet* 369 (9555), 60-70, January 2007.
- [8] Britto, P.R., and Ulkuer, N, "Child development in developing countries: Child rights and policy implications", *Child Development*, 83 (1), 92-103, January 2012.
- [9] Ministry of Health of Republic Indonesia, *National Report of Basic Health Research 2018*, Jakarta, 2019.
- [10] Bhutta, Z.A., Das, J.K., Rizvi, A., Gaffey, M.F., Walker, N., Horton, S., Webb, P., Lartey, A., Black, R.E., "Evidence-based interventions for improvement of maternal and child nutrition: what can be done and at what cost?" *Lancet* 382, 2013, 452-277.
- [11] Ruel, M.T., Alderman, H., "Nutrition-sensitive interventions and programs: how can they help to accelerate progress in improving maternal and child nutrition?" *Lancet* 382, 2013, 536-551.
- [12] Martorell, R., Under-nutrition during pregnancies and early childhood: Consequences for cognitive and behavioral development, In: Young, M.E. (ed) *Early childhood development, investing in our children's future*, International Congress Series, No. 1137, Elsevier Science, Amsterdam, 1997.
- [13] Hurley, K.M., Yousafzai, A.K., and Lopez-Boo, F., "Early child development and nutrition: a review of the benefits and challenges of implementing integrated interventions", *Adv Nutr* 7, 2016, 357-363.
- [14] Engle, P.L., Fernald, L.C., Alderman, H., Behrman, J., O'Gara, C., Yousafzai, A., de Mello, M.C., Hidrobo, M., Ulkuer, N., Ertem, I., et al, "Strategies for reducing inequalities and improving developmental outcomes for young children in low-income and middle-income countries". *Lancet* 378, 2011, 1339-1353.
- [15] Pelto, G.H., Martin, S.L., Van Liere, M., Fabrizio, C.S., "The scope and practice of behavior change communication to improve infant and young child feeding in low- and middle-income countries: results of a practitioner study in international development organizations", *Matern Child Nutr*, March 2015.
- [16] Anwar, F., "Model of under-two-year-old childcare to improve the child's nutritional status and psychosocial development", PhD Thesis, IPB University, Indonesia, Bogor, 2002
- [17] Khomsan, A., Anwar, F., Hernawati, N., Suhanda, N.S., Warsito O, Herawati, T., "Growth, cognitive development and psychosocial stimulation of preschool children in poor farmer and nonfarmer households", *Malaysian Journal of Nutrition*, 19 (3), 325-337, 2013.
- [18] Hasan, A., Hyson, M., and Chang, M.C., *Early Childhood Education and Development in Poor Villages of Indonesia: Strong Foundations, Later Success. Directions in Development*, World Bank, Washington, DC, 2013.
- [19] Nahar, B., Hossain, Md.I., Hamadani, J.D., Ahmed, T., Grantham-McGregor, S., Persson, L.A., "Effects of psychosocial stimulation on improving home environment and child-rearing practices: results from a community-based trial among severely malnourished children in Bangladesh", *BioMed Central Public Health*, 12, 622, August 2012.
- [20] Caldwell, B.M. and Bradley, R.H., *Home Inventory Administration Manual*, Comprehensive Edition, University of Arkansas for Medical Sciences, Little Rock, 2003.
- [21] Ministry of Education and Culture of Republic Indonesia, *Peraturan Menteri Pendidikan dan Kebudayaan Republik Indonesia Nomor 137 Tahun 2014 Tentang Standar Nasional Pendidikan Anak Usia Dini (A Regulation of the Ministry of Education and Culture of Republic Indonesia Number 137 of 2014 on National Standard of Early Childhood Education)*, 2014.

- [22] WHO [World Health Organization], *WHO Child Growth Standards: Length/Height-for-Age, Weight-for-Age, Weight-for-Length, Weight-for-Height and Body Mass Index-for-Age: Methods and Development*, WHO, Geneva, 2006.
- [23] BKKBN [Badan Koordinasi Keluarga Berencana Nasional] (National Family Planning Coordination Board), *Buku 1: Bahan Penyuluhan Gerakan Bina Keluarga Balita Kelompok Umur 0-5 Tahun (Book 1: Counseling Material for Movement of Toddler Family Development for Age Group 0-5 Years Old)*. BKKBN, Jakarta, 1995.
- [24] U.S. National Library of Medicine, U.S. Department of Health and Human Services National Institutes of Health, Bethesda, "Preschoolers development", MD, 2019, Available at: www.ncbi.nlm.nih.gov/pmc/articles/PMC6711111/ (accessed 11 September 2019).
- [25] Hoghughi, M., Parenting- An introduction, In: Hoghughi M and Long N (eds). *Handbook of Parenting: Theory and Research for Practice*, SAGE Publications Ltd, London, 2004, Available at: www.sk.sagepub.com (accessed 19 January 2018).
- [26] Leibowitz, A., Home Investments in Children. In: Schultz TW (ed), *Economics of the Family: Marriage, Children, and Human Capital*, The University of Chicago Press, Chicago, 1974, 432-456.
- [27] Hartoyo, "Investing in children: study of rural families in Indonesia", PhD Thesis, Virginia Tech University, Blacksburg, 1998.
- [28] Hample, K., Intergenerational transfer of human capital among immigrant families. Illinois Wesleyan University, Illinois, 2010, Available at: https://digitalcommons.iwu.edu/econ_honproj/105 (accessed 19 January 2018).
- [29] Reich, S., "What do mothers know? Maternal knowledge of child development", *Infant Mental Health Journal*, 26 (2), 143-156, March 2005.
- [30] Huang, K.Y., Caughy, M.O.B., Genevro, J.L., Genevro. J.L., Miller, T.L., "Maternal knowledge of child development and quality of parenting among White, African-American and Hispanic mothers", *Journal of Applied Development Psychology* 26 (2): 149-170, March 2005.
- [31] Aboud, F.E., Yousafzai, A.K., "Global health and development in early childhood", *Annu Rev Psychol*, 66, 2010, 433-457.
- [32] Zepeda, M., Varela, F., and Morales, A., *Promoting Positive Parenting Practices Through Parenting Education*, In: Halfon N, Rice T and Inkelas M (eds). *Building State Early Childhood Comprehensive Systems Series, No. 13*, National Center for Infant and Early Childhood Health Policy, 2004, Available at: www.ecadmin.wdfiles.com/local--files/literature-research/Promoting%20Positive%20Parenting%20Practices%20-%20NCIECHP.pdf (accessed 19 January 2018).
- [33] Ertem, I.O., Atay, G., Dogan, D.G., Bayhan, A., Bingoler, B.E., Gok, C.G., Ozbas, S., Haznedaroglu, D., Isikli, S., "Mothers' knowledge of young child development in a developing country", *Child Care Health Development*, 33 (6), 728-737, November 2007.
- [34] Hastuti, D., *Parenting Theory, Principle and Practice in Indonesia*, Department of Family and Consumer Sciences, Faculty of Human Ecology, IPB University, Bogor, 2009.
- [35] Yuliana, "*Pengaruh Penyuluhan Gizi dan Stimulasi Psikososial terhadap Pertumbuhan dan Perkembangan Anak Usia Prasekolah*" (The Influence of Nutritional Education and Psychosocial Stimulation to Preschool Children's Growth and Development), MS Thesis, IPB University, Bogor, 2007.
- [36] Caplan, F. and Caplan, T., *The Early Childhood Years: The Two- to Six-Year-Old*, Bantam Books, New York, 1983.
- [37] Black, J.K., Puckett, M.B., and Bell, M.J. *The Young Child: Development from Pre-Birth through Age Eight*, Merrill Publishing Company, New York, 1992.

