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The Impact of Sibling Age Gap, Stimulation, Father Involvement, and Parenting Stress on the Development of Children Aged 36-59 Months: A Multilevel Analysis

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ABSTRACT

Background: Early childhood development (36-59 months) is a critical period that significantly influences a child's growth, learning and overall well-being. Providing high-quality early childhood care and education is essential to maximizing children's potential for later success, as it equips them with the skills and competencies necessary for their future development.
Subjects and Method: This was a cross-sectional study conducted at 28 Early Childhood Education (PAUD) in Wonogiri, Central Java, from August to September 2024. A total of 225 children aged 36-59 months was selected for in this study. The dependent variable was child development. The independent variables at level 1 were the age gap between children, parenting stimulation, father involvement, and parental stress. The independent variable at level 2 was Early Childhood Education (PAUD). Data were collected through questionnaires and analyzed using a multiple multilevel logistic regression run on STATA 13.
Results: Age-appropriate child development at 36–59 months increased with longer age gaps between children (OR=2.06; CI 95%= 0.97 to 4.42; p= 0.061), high parenting stimulation (OR=2.04; CI 95%= 1.30 to 3.20; p= 0.002), father's involvement (OR=2.74; CI 95%= 1.22 to 6.15; p= 0.014). Child development appropriate for the age of 36-59 months old decreased with high parental stress (OR=0.34; 95% CI= 0.20 to 0.57; p<0.001). PAUD has no contextual effect on early childhood development (ICC= 0.36%).
Conclusion: Child development in children aged 36–59 months was positively associated with a wider sibling age gap, nurturing stimulation, and active father involvement in caregiving. Child development decreased with high parental stress. PAUD has no contextual effect on early childhood development.

Keywords: child, preschool, parent-child relations, stress, psychological

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BACKGROUND

Development is an important indicator in optimizing child growth according to their age. In addition, child development is a

global indicator in the sustainable development goals (SDGs). One of the goals of the SDGs is to increase the proportion of children aged 24 months to 59 months where development must be on track in terms of health, learning and education (Saptarini et al.,2021).

Child developmental delays are a major problem in Indonesia because they impact the growth and well-being of children throughout the country. The rate of child developmental delays in Indonesia requires serious attention and intervention (Sa'adah, 2024). Based on the 2018 Basic Health Research results on the development of children aged 36-59 months, the development index results were 88.3%, covering literacy aspects of 64.6%, social emotional aspects of 69.9%, learning aspects of 95.2% and physical aspects of 97.8% (Ministry of Health of the Republic of Indonesia, 2018).

According to the Regulation of the Minister of Health No. 25 of 2014, article 21, efforts to care for children, monitoring growth and development, and monitoring growth and development disorders are included in the health services for infants, toddlers and preschoolers (Early Childhood Profile, 2022). Monitoring and screening of child growth and development have been identified as important aspects of national health services in Indonesia, which emphasizes the importance of early detection and intervention for children with developmental delays (Mardiyanti and Case, 2021).

Growth and development monitoring is carried out in stages starting from using the development checklist from the KIA book. The results of the growth examination through the KIA book with incomplete interpretation are continued with growth and development examinations carried out by health workers through the Early Child Growth and Development Stimulation, Detection and Intervention (SDIDTK) activities carried out at the health center. The percentage of toddlers who received SDIDTK services nationally in 2022 was 61.3% with the highest province namely West Nusa Tenggara (89.1%), the lowest was Papua (19.2%) and the coverage percentage of toddlers served by SDIDTK in Central Java Province was 76.8% (Directorate General of Public Health, Ministry of Health of the Republic of Indonesia, 2023).

To gain a comprehensive understanding of child development, it is important to consider the various factors that influence early childhood development. Factors such as parenting interventions, parent-child coregulation, rural-urban early childhood education differences, and the role of the preschool education system play an important role in shaping children's growth and well-being (Lunkenheimer et al., 2024).

The purpose of this study is to find and analyze the effect of various components on the development of early childhood aged 36-59 months. It is hoped that effective solutions can be found by understanding how early childhood development and child age gap, parenting stimulation, father involvement and parenting stress relate to each other. This study is also expected to increase awareness of parents, caregivers, and health workers about how to help early childhood develop well. In addition, it is expected to increase awareness of the importance of child age gap, parenting stimulation, father involvement and parenting stress to support early childhood growth. Children can grow and develop optimally in terms of physical and mental according to their age.

SUBJECTS AND METHOD

1. Study Design

This was a cross-sectional study conducted

at 28 Early Childhood Education (PAUD) in Wonogiri, Central Java, from August to September 2024.

2. Population and Sample

The study population was all children aged 36-59 months in Wonogiri Regency. The study sample was 225 children aged 36-59 months selected using the randomized controlled trial (RCT) method.

3. Study Variables

The dependent variable was child development aged 36-59 months. The independent variables at level 1 were the age gap of children, parenting stimulation, father involvement and parenting stress. The independent variable at level 2 was Early Childhood Education (PAUD).

4. Inclusion Criteria

The inclusion criteria in this study were children aged 36-59 months and children who were actively attending Early Childhood Education (PAUD)/Playgroups (KB).

5. Exclusion Criteria

The collection of research samples was carried out by considering exclusion criteria, namely children who have congenital abnormalities (cleft lip, Down syndrome, cerebral palsy, heart abnormalities, etc.) and children with infectious diseases such as pneumonia, pulmonary TB, etc.

6. Definition of Operational Variable

Children age gap is the age difference between two or more children in a family. The measuring instrument uses a questionnaire.

Parenting stimulation is the interaction and activity of the environment and parents to support the physical, cognitive, social-emotional and language development of children. The data were measured using the Family Care Index.

Father's involvement is continuous active participation of fathers in child care that contains aspects of frequency, initiative and personal empowerment in the dimensions of child development. The data were measured using the Family Care Index.

Parenting stress is a condition of emotional, mental, or physical stress experienced by parents or caregivers when they feel burdened by the demands and responsibilities of caring for and educating children. The measurement instrument used is the Parental Stress Scale (PSS).

Child's development is a process of change and growth that occurs in children as they grow older, covering various physical; cognitive, emotional, social, and language aspects. The measurement instrument used is the Early Childhood Development Index (ECDI).

Role of PAUD is an effort of PAUD and the education and culture service program in providing early childhood education, providing stimulation and experience of the child's learning process in improving abilities according to the child's age development. Data collection is done by questionnaire. The measurement scale is categorical.

7. Instrument of the Study

Data collection in this study used a questionnaire adopted from UNICEF, namely FCI (Family Care Index) and to measure the development of children aged 36-59 months using ECDI (Early Childhood Development Index) which is carried out in every PAUD (Early Childhood Education).

8. Data Analysis

Univariate analysis was used to describe the frequency distribution and characteristics of the study subjects. Bivariate analysis used the chi-square test to analyze the relationship between the development of children aged 36-59 months with independent variables. Multivariate analysis used multilevel multiple logistic regression analysis. The contextual influence of PAUD on the development of children aged 36-59 months is

shown by the intra-class correlation (ICC).

9. Research Ethic

Research ethics include informed consent, anonymity, confidentiality, and ethical approval. Research ethics were obtained from the Research Ethics Committee at Dr. Moewardi Hospital, with a decree number: 1.965/VIII/HREC/2024.

RESULTS

1. Univariate Analysis

Based on Table 1, it can be seen that the type of child malnutrition is mostly dominated by males which in total are 115 (51.11%). The characteristics of father's education show the highest number at the high school/ college graduate level (90.67%). Father's work is dominated as a private employee (117%). At the level of mother's education, the highest is in high school/college graduates (83.2%) and the mother's work is predominantly as a housewife (61.78%). The most dominant family income in a month >2,500,000 (51.11%) and child care is dominated by mothers (67.56%).

Table 1 presents data from 225 research subjects, where 135 participants (60%) had an age gap between siblings of less than 2 years, and 90 participants (40%) had an age gap of 2 years or more. Low parenting stimulation was observed in 29.3% of participants, low father involvement in parenting was reported in 64%, and the absence of parenting stress was found in 62.7%. A total of 37.9% of children in the study exhibited developmental outcomes that were not age-appropriate, indicates developmental delays.

Table 1. Characteristics of Children Aged 36-59 Months (dichotomous data)

Variable		Frequency	%
Child's Gender	Male	115	51.11
	Female	110	48.89
Father's Education	Elementary – Junior high school	21	9.33
	Senior high school/ College	204	90.67
Father's Employment	Unemployed	5	2.22
	Farmer	34	15.11
	Entrepreneur	52	23.11
	Private employee	117	52.00
	Civil Servant	17	7.56
Maternal Education	Elementary – Junior high school	38	16.8
	Senior high school/ College	187	83.2
Maternal Employment	Unemployed	139	61.78
	Farmer	14	6.22
	Entrepreneur	19	8.44
	Private employee	49	21.78
	Civil Servant	4	1.78
Family Income	< 2.500.000	110	48.89
	>2.500.000	115	51.11
Child Caretaker	Mother	152	67.56
	Father	15	6.67
	Grandparents	43	19.11
	Other adults	15	6.67
Children Age Gap	< 2 years	135	60
	≥ 2 years	90	40
Parenting Stimulation	Low	66	29.3
	Moderate	58	25.8
	High	101	44.9
Father's Involvement	Uninvolved	144	64

Variable		Frequency	%
Parenting stress	Involved	81	36
	None	141	62.7
	Moderate	51	22.7
	High	33	14.7
Child Development	Not in accordance	74	32.9
	In accordance	151	67.1

2. Bivariate Analysis

Table 2 presents the results of chi square test. Children aged 36-59 months with a sibling age gap of less than 2 years are 3.14 times more likely to experience developmental outcomes that are not age-appropriate compared to those with a sibling age gap of 2 years or more. This finding highlights that a shorter age gap between siblings is significantly associated with an increased risk of developmental delays (OR= 3.14; 95% CI= 1.67 to 5.89; p < 0.001).

Children aged 36-59 months who receive adequate stimulation are 3.45 times more likely to had appropriate developmental outcomes compared to children who receive low stimulation (OR = 3.45; 95% CI = 2.35–5.06; p < 0.001).

Children aged 36-59 months with father involvement in caregiving are 4.35 times more likely to achieve appropriate developmental outcomes compared to those without such involvement (OR= 4.35; 95% CI= 2.17 to 8.72; p < 0.001).

Children with high parenting stress have a 0.20 times lower probability of achieving appropriate child development compared to those without parenting stress. High parenting stress is significantly associated with a reduced likelihood of appropriate child development (OR= 0.20; 95% CI= 0.13 to 0.32; p<0.001).

Table 2. Chi-square test results of children age gap, parenting stimulation, father involvement, parenting stress and child development aged 36-59 months old

Variable	Child's Development				Total		OR	CI (95%)	p
	Not in accordance		In accordance						
	n	%	n	%	n	%			
Children Age Gap							3.14	1.67 – 5.89	< 0.001
< 2 years	57	42.2	78	57.8	135	100			
≥ 2 years	17	18.9	73	81.1	90	100			
Parenting Stimulation							3.45	2.35 – 5.06	< 0.001
Low	45	68,2	21	31.8	66	100			
Moderate	13	22.4	45	77.6	58	100			
High	16	15.8	85	84.2	101	100			
Father's Involvement							4.35	2.17 – 8.72	< 0.001
Uninvolved	62	43.1	82	56.9	144	100			
Involved	12	14.8	69	85.2	81	100			
Parenting Stress							0.20	0.13 – 0.32	< 0.001
None	19	13.5	122	86.5	141	100			
Moderate	31	60.8	20	39.2	51	100			
High	74	72.7	9	27.3	33	100			

3. Multivariate analysis of multilevel multiple logistic regression

Child age gap <2 years (OR= 2.06; 95% CI= 0.97 to 4.42; p= 0.061), parenting stimulation (OR= 2.04; 95% CI= 1.30 to 3.20; p= 0.002), and father involvement (OR= 2.74; 95% CI= 1.22 to 6.15; p= 0.014) significantly increases child development.

Parenting stress decreased child development (OR= 0.34; 95% CI= 0.20 to 0.57; p < 0.001). PAUD has a negligible contextual effect value on child development (ICC= 0.36%).

Table 3. The results of multilevel multiple logistic regression analysis of children age gap, parenting stimulation, father involvement, parenting stress and child development aged 36-59 months old.

Variable	OR	95%		p
		Lower limit	Upper limit	
Fixed Effect				
Children age gap	2.06	0.97	4.42	0.061
Parenting stimulation	2.04	1.30	3.20	0.002
Father's involvement	2.74	1.22	6.15	0.014
Parenting stress	0.33	0.20	0.57	< 0.001
Random Effect				
PAUD				
Var (Constants)	0.04	1.49	11.25	
N Observation =225				
N PAUD = 28				
Group average= 8, min= 8, max= 9				
LR test vs Linear model:				
chibar2(01) = 0.03				
Prob ≥ chibar2= 0.4357				
Intra Class Correlation (ICC)= 0.36%				

DISCUSSION

1. Sibling Age Gap and Development of Children Aged 36-59 Months Old

Based on the results of the multilevel analysis, Table 3 shows that the development of children aged 36-59 months has a significant relationship between the age gap of children and the development of children aged 36-59 months. Every increase in one score of the child's age gap will be followed by an increase in the child's development of 2.06 (OR=2.06; CI 95%=0.97 to 4.42; p= 0.061)

This is in accordance with the results of previous studies by Feng (2023) and Bohn et.al. (2022) which suggests that smaller age gaps or <2 years can cause challenges in mastering language and increasing competition between siblings while the larger gap or age distance ≥ 2 years can facilitate the modeling of positive roles and emotional support.

Smaller age gaps often cause more competitive interactions, which can trigger conflict but also encourage social learning and empathy development (Feng, 2023). Conversely, a larger age gap can produce a more careful relationship, where older siblings exemplify positive behavior and emotional arrangements for younger siblings (Feng et al., 2021; Sun, 2020).

Siblings who are close together tend to participate in joint activities that foster cooperation skills and negotiations, important components of social development (Sun, 2020). In addition, age differences between siblings can affect motor development. Research shows that you often act as mentors, provide opportunities for younger siblings to be involved in physical activity that improves motor skills (Rodrigues et al., 2021).

Children with an age distance of ≥ 2 years have a positive interaction between

their siblings where the child's encouragement to participate in fun joint activities so that it can strengthen the bonds between siblings, social learning, cooperation skills and improve cognitive abilities of children. Consistent emotional support and the role of parents as a positive model are needed by children with an age gap of <2 years in order to reduce competition, improve the skills to overcome conflict and respect for each other. In addition to the age of children ≥2 years in increasing the development of children aged 36-59 months, the quality of interaction and the opportunity to practice is an important factor in increasing children's development.

2. Stimulation and Development of Children Aged 36-59 Months Old

Based on Table 3, there is a positive and statistically significant relationship between the stimulation of parenting and the development of children aged 36-59 months. Each increase in one care stimulation score will be followed by an increase in child development by 2.04 (OR=2.04; CI 95%= 1.30 to 3.20; p= 0.002).

This is in accordance with research conducted by Emmers (2021) and Cuartas (2020) where parents involved in stimulating activities such as reading, storytelling, and interactive play contribute positively to the cognitive skills of their children, including the development of language and executive functions Can not only increase the vocabulary and understanding of children, but also encourage critical thinking skills and problem solving. In addition, the quality of parents' stimulation is also important. High quality interactions characterized by sensitivity, responsiveness, and directed have been associated with the results of better development in children. Conversely, a low level of parental stimulation can cause delays in development and difficulties in emotional regulation (Mansur, 2022; Cuartas et al., 2020).

Stimulation of childcare is not only being beneficial in cognitive development of children but also plays an important role in socio-emotional development. Children who receive consistent emotional and parenting support from their parents tend to show better social skills and emotional arrangements (Emmers et al., 2021; Cuartas et al., 2020). In addition, aspects of the role of the environment in parenting stimulation can foster safe attachments, which are very important for the ability of children to shape healthy relationships with peers and adults and can encourage exploration and independence can increase the confidence and resilience of children (Meuwissen and Englund, 2016 in Mansur et al., 2022).

Efforts to optimize the development of children aged 36-59 months can be carried out by doing parenting stimulation that involves the activity of interaction between children and caregivers. Parents are advised to not only pay attention to consistency and frequency of stimulation but also high quality stimulation including full attention, sensitivity and appropriate responsiveness to the needs of children. In addition, creating an environment of stimulation that is rich in stimulation is needed to support optimal child development.

3. Father Involvement and Development of Children Aged 36-59 Months Old

Table 3 shows a positive and statistically significant relationship between the involvement of the father and the development of children aged 36-59 months. Every increase in one score of father's involvement will be followed by an increase in child development by 2.74 (OR=2.74; CI 95%=1.22 to 6.15; p= 0.014).

This is in line with research done by Adusei (2024) which shows that the involvement of the father has shown a positive

impact in cognitive development where children with fathers who are involved tend to achieve better academically and show an increase in language and literacy skills. Other studies also show that fathers who are actively involved in their children's education and daily activities will foster a conducive environment for learning and exploration (Pablo et.al., 2021).

The benefits of father's involvement in parenting also play a role in the emotional development of children where fathers often provide a different style of interaction compared to mothers, which can enrich the emotional development of children. Mothers realize the importance of fathers in developing the socio-social skills of their children that fathers contribute to aspects of development that may not be handled directly by mothers (Lestari & Alam, 2020). The benefits of father's involvement extend to reduce the risks associated with behavioral problems. Research shows that children with fathers involved tend not to be involved in high-risk behaviour and more resilient in facing challenges (Adusei, 2024).

Father's involvement in parenting significantly affects the increase in the development of children aged 36-59 months. This shows that besides mothers, fathers also have an important role not only useful for cognitive development, but also children's socio-emotional. The inhibiting factor of the low role of the father in parenting is the dual role of the father as the responsibility of the head of the family and the demands of the work. This can be done with quality time facilities for fathers and children, therefore, parental care for children is balanced and create better synergy in educating children.

4. Parenting Stress and Development of Children Aged 36-59 Months

Table 3 shows a positive and statistically significant relationship between the stress of parenting and development of children aged 36-59 months. Each increase in one stress score of parenting will be followed by a decrease in child development by 0.34 (OR=0.34; CI 95%=0.20 to 0.57; p < 0.001).

This is in line with research conducted by Ward and Lee (2020) and Jiang (2022) which indicates that high-parenting stress levels can affect the interaction of parents-child negatively. For example, care stress is associated with reduced response and sensitivity of parents and can cause adverse development results for children. Researchers found that indirect nurturing stress is related to the cognitive development and emotional behavior of children.

The relationship between parenting stress and child behavior is two -way, with increasing stress in caring for children can cause increased problems of children's behavior, which in turn can worsen the stress of parents, thus creating a cycle that has a negative impact on both parties (Jiang et al., 2022; Madsen et al., 2021).

Factors such as socioeconomic status, social support, and environmental cohesion play an important role in forming care stress. For example, mothers who feel a higher level of environmental social cohesion report lower stress levels, which are associated with better children's yields (Ray, 2024). Conversely, lack of social support can worsen feelings of isolation and stress, which in turn has an impact on the quality of childcare and development (Ray, 2024).

Stress in child caregivers is an important factor that affects the development of early childhood. High levels of stress can reduce parental responses, create a chaotic home environment, and contribute to the cycle of behavioral problems in children. Overcoming stress in caring for children through supporting systems and intervention is highly important to foster a healthier parent-child relationship and

encourage optimal development results for children. This underlines the importance of overcoming the stress of parenting not only for the sake of parents but also for the welfare of the children involved.

5. PAUD and Development of Children Aged 36-59 Months

PAUD has a low contextual effect on the development of children aged 36-59 months with ICC = 0.36% <8-10%. It shows that 0.36% variations of the development of children aged 36-59 months are not determined by factors at the PAUD level such as the quality of facilities or educational programs of each PAUD. Most variations of child development are influenced by other factors such as stimulation of parenting, family environment and individual characteristics of children aged 36-59 months.

AUTHOR CONTRIBUTIONS

Rulita Ayu Rachmawati is the main researcher who selects topics, searches and collects study data. Rita Benya Adriani, Bhisma Murti analyzed the data and reviewed the study documents.

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CONFLICTS OF INTEREST

There was no conflict of interest in this study.

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