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Effects of Social Economy, Exclusive Breastfeeding, Complementary Feeding, and Physical Environment on the Stunted Children's Development

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ABSTRACT

Background: Stunting in children under five is a global health problem that demands serious attention from various parties. Various factors causing developmental delays in stunted children under five have been identified, including inadequate nutritional intake, frequency of illness, poor sanitation, and socioeconomic factors. The development of stunted toddlers is a serious challenge in the context of child health and human development as a whole. This study aims to analyze direct and indirect effect on the development of stunting toddlers.
Subjects and Method: This was an observational analytical study design using cross sectional approach. The study used random sampling technique using random number generator. This study was conducted at posyandu (integrated health post) for children under five in the working area of Karimun Regency Community Health Center. The number of samples in this study amounted to 200 stunted children under five. The data analysis used was path analysis with STATA 17.
Results: The results of the path analysis explained that there was a direct effect of sex category on development of stunted children under five (OR= 1.15; 95% CI= 0.60 to 2.20; p = 0.659), age on development of stunted children under five (OR= 2.53; 95% CI= 1.26 to 5.06; p = 0.008), exclusive breastfeeding on development of stunted children under five (OR= 2.35; 95% CI= 1.20 to 4.60; p = 0.012), complementary food on development of stunted children under five (OR= 2.45; 95% CI= 1.18 to 5.07; p = 0.015), frequency of illness on development of stunted children under five (OR= 0.56; 95% CI= 0.29 to 1.07; p= 0.083). There was an indirect effect of maternal education and family income (OR= 7.94; 95% CI= 3.34 to 18.87; p<0.001), maternal education on exclusive breastfeeding (OR= 7.22; 95% CI= 3.56 to 14.64; p<0.001), family income on exclusive breastfeeding (OR= 0.83; 95% CI= 0.39 to 1.76; p = 0.636), family income on physical environment (OR= 3.77; 95% CI= 1.79 to 7.97; p<0.001), physical environment on frequency of illness (OR= 0.22; 95% CI= 0.11 to 0.42; p<0.001), exclusive breastfeeding on frequency of illness (OR= 0.59; 95% CI= 0.31 to 1.12; p= 0.110). Exclusive breastfeeding on complementary foods, (OR= 4.33; 95% CI= 2.22 to 8.44; p< 0.001).
Conclusion: The results of this study reveals that there is a direct effect of gender, age, exclusive breastfeeding, complementary foods and frequency of illness on the development of stunted children under five. There is an indirect effect of maternal education, family income, exclusive breastfeeding and physical environment on development of stunted children under five.

Keywords: stunting, child development, exclusive breastfeeding, complementary food, physical environment, social economy.

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BACKGROUND

Early childhood, referring to infants under 5 years (children under five) in the early period of life, is the most rapid and sensitive period of children's brain growth and development (Zhang et al., 2018). Stunting is one of the health problems that contributes to most of the burden of disease and results in premature deaths that can actually be prevented (World Health Organization, 2021). The problem of stunting is expected to burden the national socioeconomic and health system (De Onis and Branca, 2016). Family economic status has an impact on family capabilities in meeting the nutritional needs of children under five (Ngaisyah, 2015).

Stunted children under five are susceptible to illness that causes decreased appetite and results in delayed growth and development (Sahitarani et al., 2020). Exclusively breastfeeding for the first six months and providing complementary foods for at least the first two years is very beneficial for stunted children under five as it affects the immune system, cognitive development, and motor skills development (Luengo et al., 2019). The breastfeeding process that occurs directly provides motor and sensory stimulation that is important for the development of the baby's muscles and nervous system (Indonesian Pediatrician Association, 2013).

In children under five, aspects of growth and development are the main focus since they describe the process of formation of the individual, both in terms of physical and psychosocial (Rosyidah et al., 2021). Condition of stunting has an effect on cognitive, social development of emotional, physical and language of children (Ngura et al., 2021). A meta-analysis study conducted by Rosyidah et al. (2021) obtain a result that stunting increases the risk of abnormal development in children with scores (aOR= 3.71; 95% CI= 2.35 to 5.86; p= 0.760).

According to WHO (2014) stunting that occurs in children will be one of the most significant obstacles to the development of children under five. By looking at the background above, it is necessary to conduct a more thorough study on the direct and indirect effects on the development of stunted children under five. This study was also conducted because the impact or consequences on the development condition of stunted children under five may last for a lifetime and even affect the next generation of the nation.

SUBJECTS AND METHOD

1. Study Design

The study design used in this study was an observational analytical study using the cross-sectional approach. Multivariate analysis was conducted using path analysis technique. Path analysis is a method for analyzing variables, with both direct and indirect association.

2. Population and Sample

The target population in this study was stunted children under five. While the source population in this study was stunted children under five in the working area of

the Tanjungbalai Community Health Center, Karimun Regency**.** The sampling technique used in this study was random sampling with a number generator. The number of samples to be selected in this study was 200 stunted children under five.

3. Study Variables

Independent variables were sex category, age, maternal education, family income, exclusive breastfeeding, complementary foods, frequency of illness of children under five, and physical environment. Dependent variable was development of stunted children under five.

4. Operational Definition of Variables

Sex category: Sex category refers to biological and social categories that are differentiated based on the roles that are commonly identified as male or female. Value 0= male and value 1= female.

Age: The definition of age refers to the period of time that has elapsed since birth. Value 0=<3 years and value 1=≥3 years.

Maternal Education: Formal education that has been taken by study subjects. Grade 0=<High School and grade 1= ≥High School

Family Income: Activities carried out to meet the needs of life. Average monthly income to support the whole family. Value 0=<IDR 3,500,000 and value 1= ≥IDR 3,500,000

Exclusive Breastfeeding: Breastfeeding babies from birth to 6 months of age (fully breastfed). Value 0= Not getting exclusive breastfeeding and value 1= Getting exclusive breastfeeding.

Complementary foods for breast milk (MPASI): Complementary feeding given to complete nutritional intake of infants since the age of 6 months. Value 0= Complementary food non-as-required and value 1= Complementary food as required.

Frequency of Illness in children under five: The frequency or the number of children under five who experience illness such as infectious diseases or non-infectious diseases during the last 1 year. Value 0= Rarely sick <2x/month and Value 1= Often sick ≥2x/month.

Physical Environment: Everything around humans, one of which is an effort to maintain the surrounding environment such as water, sanitation and hygiene. Value 0= Poor physical environment and Value 1= Good physical environment.

Development: Development can refer to processes or changes that occur over time in various contexts in this study, namely motor, language and personal social. Value 0= Delay and Value 1= Normal.

5. Study Instruments

Data collection related to sex category, age, maternal education, family income, exclusive breastfeeding, complementary food, physical environment, and frequency of illness was carried out using interview technique with questionnaires. While the assessment instruments for dependent variable development was Denver Development Screening Test II (DDST II) (Wahyudi and Sufriani, 2018). DDST II has met all the necessary criteria as a good screening method (Soetjiningsih and Ranauh, 2012). In this DDST II measurement, there were 4 assessment items to be evaluated, namely fine motor development, gross motor development, language development and personal social development.

6. Data Analysis

Univariate analysis was used to give an idea of the characteristics of study respondents. Continuous data were described using the parameters of frequency (n), Mean, standard deviation (SD), minimum value, and maximum value. Meanwhile, categorical data were described using parameters of frequency (n) and percentage (%).

Bivariate analysis was performed to

understand the association between two variables. The difference in proportions between the groups was tested using the chi-square test.

Multivariate analysis was conducted using path analysis techniques (path analysis). Path analysis is a method for analyzing variables, both those that have direct and indirect association (Statue, 2019).

7. Research Ethics

Research ethics including informed consent, anonymity, and confidentiality, were handled carefully throughout the study process. The research ethics clearance was obtained from the Research Ethics Committee of Dr. Moewardi Regional General Hospital, Indonesia, No. 1,850/X/HREC/2023, on October 18, 2023.

RESULTS

1. Univariate Analysis of Sample Characteristics

The characteristics of the study sample univariately explained the distribution of study subjects based on independent variables, namely age, sex, maternal education, family income, exclusive breastfeeding, complementary foods, frequency of illness, physical environment and dependent variables, namely the development of stunted children under five.

Table 1. Sample characteristics (continuous data)

Variable	n	Mean	SD	Min.	Max.
Age of Children under Five	200	2.87	0.80	2	4
Maternal Education	200	0.71	0.76	0	2
Family Income	200	2483	1108.99	1,000,000	9,000,000
Exclusive Breastfeeding	200	1.83	1.18	0	3
Complementary food	200	2.65	1.27	0	4
Frequency of Illness	200	1.83	0.80	1	4
Physical Environment	200	9.04	3.97	2	14

Table 1. presents descriptive statistical results of variables concerning the number of subjects studied, minimum value, maximum, Mean and standard deviation. Mean represents the average, while standard deviation (SD) describes how far the data vary. The age variable with 200 study subjects had an average value of 2.87 (Mean = 2.87; SD= 0.80) with the lowest value of 2 and the highest value of 4.

Maternal education with 200 study subjects had an average value of 0.71 (Mean = 0.71; SD= 0.76) with the lowest value of 0 and the highest value of 2. The family income variable with 200 study subjects had an average value of 2483 (Mean= 2483; SD= 1108.99) with the lowest value of Rp.1,000,000 and the highest value of Rp.9,000,000. The history of exclusive breastfeeding variable with 200 study subjects had an average value of 1.83 (Mean = 1.83; SD= 1.18) with the lowest value of 0 and the highest value of 3. The complementary food variable with 200 study subjects had an average value of 2.65 (Mean= 2.65; SD= 1.27) with the lowest value of 0 and the highest value of 4. While the frequency of illness variable with 200 study subjects had an average value of 1.83 (Mean = 1.83; SD= 0.80) with the lowest value of 1 and the highest value of 4. The physical environment variable with 200 study subjects had an average value of 9.04 (Mean = 9.04; SD= 3.97) with the lowest value of 2 and the highest value of 14.

Table 2. shows that the majority of the

study subjects were stunted children under five, male with a total of 104 study subjects (52%). The age characteristic was ≥3 years with a total of 121 study subjects or (60.5%).

Stunted children under five with no history of exclusive breastfeeding were 124 subjects or (62%). While stunted children under five with a history of complementary food as required were 121 study subjects or (60.5%). Stunted children under five who frequently sick ≥2x / month were 121 study subjects or (60.5%).

In the characteristics of maternal education, there were 104 study subjects or (52%) with education≥ high school. The majority of study subjects with family income characteristics had a low income of <Rp 3,500,000 with a total of 153 study subjects or (76.5%). Good physical environment characteristics with 107 study subjects or (53.5%). For the development characteristics of stunted children under five there were 135 subjects (67.5%) who experienced developmental delays.

2. Bivariate Analysis

It explained the effect of independent variables, namely age, sex, maternal education, family income, exclusive breastfeeding, complementary food, frequency of illness and physical environment on the dependent variable, namely the development of stunted children under five. The analysis test used in bivariate analysis was a chi-square with a confidence interval of 95% ($p<0.05$).

Table 2. Sample characteristics (categorical data)

Variable	Frequency	Percentage (%)
Sex Category		
Male	104	52
Female	96	48
Children's Age		
<3 years	79	39.5
≥3 years	121	60.5
Maternal Education		
Low (<High School)	96	48
High (≥High School)	104	52
Family income		
Low (<Rp.3.500.000)	153	76.5
High (≥Rp.3.500.000)	47	23.5
History of exclusive breastfeeding		
Non-Exclusive Breastfeeding	124	62
Exclusive Breastfeeding	76	38
History of Complementary Food		
Non-as-required	79	39.5
As-required	121	60.5
Frequency of pain		
Rarely sick (<2x/month)	79	39.5
Frequently sick (≥2x/month)	121	60.5
Physical Environment		
Poor	93	46.5
Good	107	53.5
Development of Stunted Children underfive		
Delay	135	67.5
Normal	65	32.5

Table 3. Chi-square of the effect of age, sex, maternal education, family income, exclusive breastfeeding, complementary foods, frequency of illness and physical environment on the development of stunted children under five

Independent Variables	Development of Stunted Children under Five						OR	p
	Normal		Delay		Total			
	n	(%)	n	(%)	n	(%)		
Sex Category								
Male	33	32	71	68	104	100	2.02	0.809
Female	32	33.3	64	66.7	96	100		
Age (year)								
<3 years	19	24	60	76	79	100	1.93	0.039
≥3-5 years	46	38	75	62	121	100		
Maternal Education								
Low < High School	21	22	75	78	96	100	2.61	0.002
High ≥High School	44	42	60	58	104	100		
Family Income								
Low <3.500.000	44	29	109	71	153	100	2.00	0.041
High ≥3.500.000	21	45	26	13	55	100		
Exclusive Breasfeeding								
Non-Exclusive Breastfeeding	29	23	95	77	124	100	2.94	0.004
Exclusive Breastfeeding	36	47	40	53	76	100		
Complementary Food								
Non-as-required	15	19	64	81	79	100	3.00	<0.001
As required	50	41	71	59	121	100		
Frequency of Illness								
Rarely sick (<2x/month)	34	43	45	57	79	100	0.45	0.010
Often sick (≥2x/month)	31	26	90	74	121	100		
Physical Environment								
Poor physical environment	21	23	72	77	93	100	2.39	0.005
Good physical environment	44	41	63	59	107	100		

a. The effect of age on the development of stunted children under five

Table 3 presents the results of the chi-square analysis, there was an effect of age on the development of stunted children under five and it was statistically significant. Stunted children under five aged ≥3 years were 1.93 times more likely to have normal development than stunted children under five aged <3 years (OR= 1.93; 95% CI= 0.98 to 3.87; p= 0.039).

b. The effect of sex category on the development of stunted children under five

Table 3 presents the results of the chi-square analysis, there was an effect of sex category on the development of stunted children under five and it was statistically non-significant. Stunted female children under five were 2.61 times more likely to have normal development than stunted male children under five (OR= 1.07; 95% CI= 0.56 to 2.02; p= 0.809).

c. The effect of maternal education on the development of stunted children under five

Table 3 presents the results of the chi-square analysis, there was an effect of maternal education on the development of stunted children under five and it was statistically significant. Mothers with higher education were 2.61 times more likely to have stunted children under five with normal development than mothers with low education (OR= 2.61; 95% CI= 1.35 to 5.14; p= 0.002).

d. The effect of family income on the development of stunted children under five

Table 3 presents the results of the chi-square analysis, there was an effect of family income on the development of stunted children under five and it was statistically significant. Families with high income were 2.00 times more likely to have stunted children under five with normal development than families with low income (OR= 2.00; 95% CI= 0.95 to 4.12; p= 0.041).

e. The effect of exclusive breastfeeding on the development of stunted children under five

Table 3 presents the results of the chi-square analysis there was an effect of exclusive breastfeeding on the development of stunted children under five and it was statistically significant. Stunted children under five who were exclusively breastfed were 2.94 times more likely to have normal development than children under five who were not exclusively breastfed (OR= 2.94; 95% CI= 1.52 to 5.69; p= 0.004).

f. The effect of complementary food on the development of stunted children under five

Table 3 presents the results of the chi-square analysis, there was an effect of complementary food on the development of stunted children under five and it was statistically significant. Stunted toddlers who get as-required complementary food were 3.00 times more likely to have normal development than stunted children under five who have non-as-required complementary food (OR= 3.00; 95% CI= 1.47 to 6.30; p<0.001).

g. The effect of illness frequency on the development of stunted children under five

Table 3 presents the results of the chi-square analysis, there was an effect of the frequency of illness on the development of stunted children under five and it was statistically significant. Stunted children under five who were frequently sick were 0.45 times more likely to have normal development compared to stunted children under five who were rarely sick (OR= 0.45; 95% CI= 0.23 to 0.87; p= 0.010).

h. The effect of the physical environment on the development of stunted children under five

Table 3 presents the results of the chi-square analysis, there was an effect of the physical environment on the development of stunted children under five and it was statistically significant. Children under five with good physical environment were 2.39 times more likely to have normal development than children under five with poor physical environment (OR= 2.39; 95% CI= 1.23 to 4.69; p= 0.005).

3. Multivariate Analysis

Multivariate analysis in this study used path analysis. Data processing in this study used the STATA 17 program application. Based on the path analysis on the results of the study, the following results were obtained:

Figure 1. explains that development of children under five to be affected directly and indirectly. The development of children under five was directly affected by age, sex category, exclusive breastfeeding, complementary food, and the frequency of illness.

Furthermore, it explains that the development of children under five was indirectly affected by maternal education through family income and exclusive breastfeeding. The development of children under five was indirectly affected by family income through the physical environment and frequency of illness.

Then the development of children under five was affected indirectly by exclusive breastfeeding variable through complementary foods. Finally, the development of children under five was affected indirectly by exclusive breastfeeding variable through

the frequency of illness.

a. Model path analysis

The complete description of the results of multivariate analysis using path analysis will be explained as follows (Table 4).

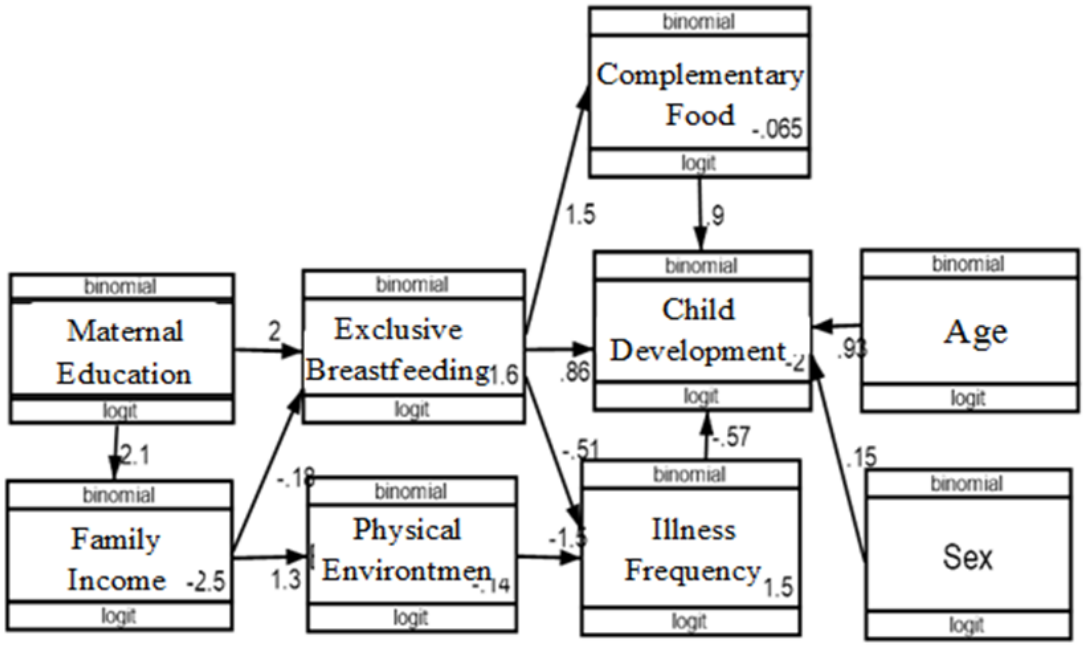

Figure 1. Structural model with estimate of effects of social economy, exclusive breastfeeding, complementary feeding, and physical environment on the stunted children's development

b. Parameter Estimation

Table 4. Results of pathway analysis on sex category, age, family income, maternal education, exclusive breastfeeding, complementary foods, frequency of illness, physical environment and development of stunted children under five

Dependent Variable		Independent Variables	OR	95% CI		p
				Lower Limit	Upper Limit	
Direct Effect						
Stunted children's development	←	Female	1.15	0.60	2.20	0.659
	←	Age ≥3 years	2.53	1.26	5.06	0.008
	←	Exclusively Breastfed	2.35	1.20	4.60	0.012
	←	Get complementary foods	2.45	1.18	5.07	0.015
	←	Frequently Sick ≥2x/ month	0.56	0.29	1.07	0.083
Indirect Effect						
Family Income	←	Maternal Education ≥ High School	7.94	3.34	18.87	<0.001
Exclusive breastfeeding	←	Maternal Education ≥ High School	7.22	3.56	14.64	<0.001
Exclusive breastfeeding	←	Family Income ≥Rp3,500,000	0.83	0.39	1.76	0.636
Physical Environment	←	Family Income ≥Rp3,500,000	3.77	1.79	7.97	<0.001
Frequency of illness	←	Exclusively Breastfed	0.59	0.31	1.12	0.110

Dependent Variable		Independent Variables	OR	95% CI		p
				Lower Limit	Upper Limit	
Frequency of illness	←	Good Physical Environment	0.22	0.11	0.42	<0.001
Complementary Food n Observation=	← 200	Exclusively Breastfeed	4.33	2.22	8.44	<0.001

1) Direct effect of sex category on the development of stunted children under five

Table 4 explains that there was a direct effect of sex on the development of stunted children under five and it was statistically insignificant. Stunted female children under five were 1.15 times more likely to have normal development compared to stunted male children (OR= 1.15; 95% CI= 0.60 to 2.20; p = 0.659).

2) Direct effect of age on the development of stunted children under five

Table 4 explains the effect of age on the development of stunted children under five and it was statistically significant. Stunted children under five aged ≥3 years were 2.53 times more likely to have normal development compared to stunted children under five aged <3 years (OR= 2.53; 95% CI= 1.26 to 5.06; p= 0.008).

3) Direct effect of history of exclusive breastfeeding on development of stunted children under five

Table 4 explains that there was a direct effect of exclusive breastfeeding on the development of stunted children under five and it was statistically significant. Stunted children under five who were exclusively breastfed were 2.35 times more likely to have a normal development compared to stunted children under five who were not exclusively breastfed (OR= 2.35; 95% CI= 1.20 to 4.60; p= 0.012).

4) Direct effect of the history of giving complementary food on the development of stunted children under five

Table 4 explains that there was a direct effect of complementary food on the development of stunted children under five and it was statistically significant. Stunted children under five who obtained complementary food as-required were 2.45 times more likely to have a normal development compared to stunted children under five who obtained non-as-required complementary food (OR= 2.45; 95% CI= 1.18 to 5.07; p= 0.015).

5) Direct effect of frequency of illness on the development of stunted children under five

Table 4 explains that there was a direct effect of frequency of illness on the development of stunted children under five and it was statistically insignificant. Stunted children under five who were frequently sick were 0.56 times more likely to have a normal development compared to stunted children under five who rarely got sick (OR= 0.56; 95% CI= 0.29 to 1.07; p= 0.083).

6) Indirect effect of maternal education on the development of stunted children under five through family income

Table 4 explains that there was an indirect effect of maternal education on family income and it was statistically significant. Mothers whose education ≥high school were 7.94 times more likely to earn income ≥Rp 3,500,000 compared to those with maternal education < high school (OR= 7.94; 95% CI= 3.34 to 18.87; p<0.001).

7) Indirect effect of maternal education on the development of stunted children under five through exclusive breastfeeding

Table 4 explains that there was an effect of maternal education on exclusive breastfeeding and it was statistically significant. Mothers whose education ≥ high school were 7.22 times more likely to have stunted toddlers who were exclusively breastfed compared to those whose education < high school (OR= 7.22; 95% CI= 3.56 to 14.64; p<0.001).

8) Indirect effect of family income on the development of stunted children under five through exclusive breastfeeding

Table 4 explains that there was an effect of family income on exclusive breastfeeding and it was statistically insignificant. Families whose income ≥Rp 3,500,000 were 0.83 times more likely to have stunted children under five who were exclusively breastfed compared to families whose income <Rp 3,500,000 (OR= 0.83; 95% CI= 0.39 to 1.76; p= 0.636).

9) Indirect effect of family income on the development of stunted children under five through the physical environment

Table 4 explains that there was an effect of family income on the physical environment and it was statistically significant. Families whose income ≥Rp 3,500,000 were 3.77 times more likely to have a good physical environment compared to families whose income of <Rp.3,500,000 (OR= 3.77; 95% CI= 1.79 to 7.97; p<0.001).

10) Indirect effect of exclusive breastfeeding on the development of stunted children under five through the frequency of illness

Table 4 explains that there was an effect of exclusive breastfeeding on the frequency of illness and it was statistically insignificant. Stunted children under five who were exclusively breastfed were 0.59 times more likely to be sick often compared to stunted children under five were not exclusively breastfed (OR= 0.59; 95% CI= 0.31 to 1.12; p= 0.110).

11) Indirect effect of physical environment on the development of stunted children under five through the frequency of illness

Table 4 explains the effect of the physical environment on the frequency of illness and it was statistically significant. Stunted children under five with a good physical environment were 0.22 times more likely to be sick often compared to those with poor physical environment (OR= 0.22; 95% CI= 0.11 to 0.42; p<0.001).

12) Indirect effect of exclusive breastfeeding on the development of stunted children under five through complementary foods

Table 4. explains that there was an effect of exclusive breastfeeding on complementary foods and it was statistically significant. Stunted children under five who were exclusively breastfed were 4.33 times likely to obtain complementary food as required compared to stunted children under five who were not exclusively breastfed (OR= 4.33; 95% CI= 2.22 to 8.44; p< 0.001).

DISCUSSION

1. The effect of age on the development of stunted children under five

The result of this study there was a direct effect of age on the development of children under five. Children under five ≥3 years old were 2.53 times more likely to have normal development. In line with a study by (Suryaputri et al., 2014) children under five aged 24-35 months have a 3.81 times higher risk of potential developmental delays compared to children aged 36-59 months. This is because each age phase of children

under five goes through various stages that vary according to their age range, with each phase involving different activities and levels of difficulty (Wiyani, 2016).

Children under five have better motor skills as they age due to the development of maturity of their body and muscle functions (Anandita, 2017). Motor skills, both gross and fine, develop over time. For example, the ability to walk, draw, or write. In their early language development and communication skills, children under five learn to speak and then understand and use language more complex over time.

Personal social development of children under five sharpens the ability to interact with others, recognize and manage emotions, and form interpersonal relationships. Every aspect of development of children under five gets better with age. Therefore, children under five ≥3 years old have better development than children under five <3 years old.

2. The effect of sex category on the development of stunted children under five

The result showed that there was a direct effect of sex category on the development of stunted children under five and it was statistically insignificant. A study (Dinkel and Snyder, 2020) suggests that in early life there may be differences in fine motor skills between female and male. Female children under five show superior fine motor skills and show a higher tendency to play with toys independently compared to male children under five. In contrast, male children under five tend to play with toys at higher intensity levels, both when playing alone and with parents, compared to female toddlers.

In the first four months of infants' life, motor differences between male and female may arise due to biological differences, however after passing through this period, the potential of the infants' motor system becomes relatively similar due to the effect of parenting or stimulation practices provided (Sterling et al., 2012). The difference in motor skills in children under five suggests that female may have higher expertise in locomotor motor skills such as running and jumping, while male may be more skilled at controlling objects such as kicking and throwing (Veldman et al., 2018).

3. The effect of exclusive breastfeeding on the development of stunted children under five.

The result of the analysis showed that there was a direct effect of the history of exclusive breastfeeding on the development of stunted children under five and it was statistically significant. A study by (Koh, 2017) concludes that mothers who breastfeed exclusively have a positive impact on development 2.5 times greater than mothers who do not breastfeed exclusively.

In this study, there was an indirect effect of exclusive breastfeeding through complementary food on the development of stunted children under five. Exclusively breastfeeding for the first six months and providing complementary foods for at least the first two years is very beneficial for stunted children under five because it affects the immune system, cognitive development, and motor skills development (Luengo et al., 2019). Motor development, which involves muscle and nerve abilities, needs to be trained as early as possible to prevent delays (Putri et al., 2023).

There was an effect of exclusive breastfeeding through the frequency of illness on the development of stunted children under five and it was statistically insignificant. Breast milk exerts a protective effect on newborns, and infants who do not obtain breast milk are likely to have a high incidence, duration, and severity of diseases such as diarrhea and pneumonia that contribute to

malnutrition (Liben et al., 2016).

The results of this study discovered that infants who still experience frequent illness regardless of being exclusively breastfed is due to improper breastfeeding. Stunted children under five who consume breast milk from bottles have a higher risk of developing infections, including diarrhea (Liben et al., 2016). Bottle feeding (especially bottles with a pacifier at the end) is not recommended because improper sanitation associated with bottle feeding can carry pathogens to the baby (Central Statistical Authority, 2014).

4. The effect of complementary food on the development of stunted children under five.

The result of the analysis showed that there was a direct effect of complementary feeding on the development of stunted children under five and it was statistically significant. It is in line with a study (Abeway et al., 2018) which concludes that if children under five are not given complementary food as required, they can increase the risk of stunted development by 2.4 times than children under five who accordingly get complementary food and in the first six months.

The impact of providing complementary foods can help the development of infant motor skills. From grasping food, to putting it in the mouth, to chewing and swallowing, everything contributes to fine and gross motor development (Kementerian Kesehatan Republik Indonesia, 2018).

5. The effect of frequency of illness on the development of stunted children under five.

The results of the analysis showed that there was a direct effect of the frequency of illness on the development of stunted children under five and it was statistically insignificant. Children under five with obstructed body growth tend to experience recurrent infections, which can result in impaired absorption of nutrients in their body (Abeway et al., 2018). In addition to disease factors and nutritional intake patterns, the development stage of children under five is the most susceptible period to various health problems in infants. This is due to the difficulty of children under five in getting adequate food intake while their activity tends to be higher (Nurbawena et al., 2021).

The frequency of illness in children under five can affect various aspects of development, such as physical, cognitive, and social-emotional growth. When children under five experience frequent illness, it can interfere with diet, sleep, and daily activities, which in turn can slow their development. Therefore, efforts to prevent disease and provide adequate health care to children under five are very important in supporting optimal children under five developments.

In addition, the explanation related to the frequency of illness, there is a direct effect that is statistically insignificant on the development of children under five. One's development is affected by many factors, including genetics, environment, nutrition, stimulation, and various things. Some children under five may get sick frequently but can still experience normal development, while other children under five who rarely get sick may also experience other developmental problems.

6. The effect of maternal education on the development of stunted children under five

The result of this study showed that there was an indirect and statistically significant effect of maternal education on the development of stunted children under five. Education can affect the attitudes and skills of mothers in nurturing their children in families within a period of the first 1000 days of life (Sartika et al., 2021). Children under five who live in families with low education levels tend to experience slow

development because of improper nurturing patterns (Sutarto et al., 2020).

In this study, there was an indirect effect of maternal education through a history of exclusive breastfeeding on the development of stunted children under five. A study by (Tiwari et al., 2014) explains that children under five who are breastfed exclusively and born to highly educated mothers. Maternal education level has a significant role in determining how the mother properly breastfeeds and prepare food (Mgongo et al., 2017).

There was an indirect effect of maternal education through family income, physical environment and frequency of illness on the development of stunted children under five. Maternal education affects the higher family income. Higher family income is associated with better utilization of health services, smoother access to quality and abundant food, more optimal nutrition, and better household ownership (Matanda et al., 2014).

7. The effect of family income on the development of stunted children under five

The result of this study showed that there was an indirect and statistically significant effect of family income on the development of stunted children under five. It is in line with a study (Dahl dan Lochner, 2017) that argue that low income is indirectly related to all aspects of child development. This impact can occur because low family income can hinder family access to quality, diverse, and nutritious food (Desalegn et al., 2016).

Socioeconomic status has an impact on household food security, and subsequently children's growth and development. Children from poor households have limited access to things like food and health services, which makes them more vulnerable to growth failure (Chowdhury et al., 2016).

Family income does not have a significant effect on exclusive breastfeeding. This can be explained that, although income affects access to all resources such as education, good environment, facilities and infrastructure, however maternal confidence or social support can also play a role in the decision to exclusively breastfeed. In addition, families with lower incomes may have different spending priorities. In investigating the relationship between family income and exclusive breastfeeding practices, it is important to consider complex factors and additional variables that might affect a breastfeeding mother's decision. A further study with a more in-depth design and involving social and cultural contexts can provide a more complete understanding of this phenomenon.

8. The effect of the physical environment on the development of stunted children under five

The result of this study showed that there was an indirect and statistically significant effect of the physical environment through the frequency of illness on the development of stunted children under five. A better home environment has a 15% higher chance for children under five to get normal development (Gao et al., 2021).

Individually, it is discovered that improved drinking water quality, better sanitation facilities, and adequate living space correlated with corresponding cognitive development. When all housing characteristics were incorporated into the same model, the results show that improved sanitation facilities and adequate living space were independently associated with a higher likelihood of experiencing normal cognitive development (Gao et al., 2021). A meta-analysis study conducted in Indonesia, Brazil, Pakistan, and India concludes that having access to household sanitation facilities is associated with improved

cognitive abilities in children (Sclar et al., 2017).

The researchers' findings indicate that children under five who experience frequent diarrhea have a higher risk of malnutrition than children who rarely have diarrhea. High rates of diarrheal infections in children can be generated by poor physical environmental status. Environmental sanitation will affect toddler nutrition, this is because poor sanitation can cause infectious diseases in children under five such as diarrhea which can interfere with the digestive process in the process of nutrient absorption (Kuewa et al., 2021). If the condition of illness occurs for a long time, it can worsen health which has an impact on the development of stunted children under five.

AUTHOR CONTRIBUTION

All authors have made significant contributions to data analysis as well as preparing the final manuscript.

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CONFLICT OF INTEREST

The author declares there was no conflict of interest.

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