A Matched *Case-Control*: Effect of Early Initiation of Breast Feeding, Exclusive Breastfeeding, and Infectious Diseases on Stunting Incidence during the Covid-19 Pandemic in Balangan Regency

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Abstract. Background: The Covid-19 pandemic is thought to affect a number of causes of stunting, including exclusive breastfeeding, early breastfeeding initiation, and illness exposure. Objectives: This study aims to investigate the effect of early initiation of breastfeeding, exclusive breastfeeding, and infectious diseases on stunting during the Covid-19 pandemic. Methods: The study was conducted in 6 stunting focus location villages in 2 subdistricts in Balangan Regency in June 2022. Children aged 6-23 months, both stunted and normal, served as the case samples in the *case-control* research design. Utilizing the Lemeshow formula, 66 samples with a 1:2 comparison were selected using a *simple random sampling* technique. In the *case* and *control* groups, the characteristics were equalized based on gender and age. Statistical analysis was conducted using the *chi-square test* and *binary logistic regression*. Results: early initiation of breastfeeding (p=0.001, OR=6.806, CI=2.185-21.201), exclusive breastfeeding (p=0.021, OR=4.080, CI=1.363-12.209) and infectious diseases (p=0.000, OR=12.244, CI=3.118-48.086). Infectious diseases had the most influence on the incidence of stunting during the Covid-19 pandemic, proved by the magnitude of the OR value. Conclusions: During the Covid-19 pandemic, the rate of stunting was influenced by early breastfeeding initiation, exclusive breastfeeding, and infectious diseases.

1 Introduction

The problem of stunting in children is starting to be quite worrying because there is an increase in the prevalence of stunting in the world such as in the year 2020 there was an increase in the prevalence of stunting from 2019, which is from 24.7% up to 27.4% in the Southeast Asia sub-region. [1-2]. Meanwhile, the threshold stunting prevalence in the world that was set to no more than 20% [3]. Relevant to the problem of stunting in the world, Indonesia also contributes a fairly high prevalence of stunting at 30.8%. South Kalimantan

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is among the top 10 provinces with a high contribution to the prevalence of stunting out of all the 34 provinces in Indonesia, which is at 33% [4]. Balangan Regency is known to have the highest prevalence in South Kalimantan for 2 consecutive years from 2019 to 2020 [5-6].

The high prevalence of stunting is an indicator that stunting in children is a serious and worrying problem because the prevalence of stunting in Balangan Regency in 2019 was 26.5% in 2019 and 26.2% in 2020 while the target set by the Indonesian government and local governments contained in the national medium-term development plan (RPJMN) target for 2020-2024 stunting prevalence is not more than 14% and the regional medium-term development plan (RPJMD) target for South Kalimantan Province in 2016-2021 stunting prevalence is not more than 22% [7-8].

Stunting is a condition where children look and appear physically in a state of short posture. Stunting does not necessarily occur immediately in children, but occurs slowly over a long time continuously or commonly referred to as chronic [9-10]. The parameters of a child are said to be stunted if the index value of the results of measuring length or height according to age is at a Z-Score of -3 SD to -2 SD, then it can be called a stunted child [11]. Children who are stunted tend to be different from children in general, not only have a short body but are also prone to illness, and decreased brain capabilities so that when children reach adulthood they have a higher chance to be less productive [12].

Some factors that cause stunting include parenting patterns such as early breastfeeding initiation and exclusive breastfeeding and environmental sanitation which are closely related to infectious diseases in children [13]. As well as the results of other studies which state that stunting can happen if children do not get early breastfeeding initiation, exclusive breastfeeding or children exposed to infectious diseases [14].

The already alarming stunting problem is exacerbated by the arrival of the Covid-19 pandemic in the first quarter of 2020. Of course, it has a very bad impact on all sectors, especially the health sector. The main focus of attention is the health aspect, especially child health, and in this case it's stunting. The health sector is certain to experience obstacles such as disruption of health service activities and monitoring of child nutrition caused by the implementation of health protocols established by the government. Relevant to the opinion of other researchers that during the Covid-19 pandemic, it can cause negative effects on high-risk groups such as children and pregnant women, which could lead to limitations in obtaining health services, obstruction of the health monitoring process and nutritional education to mothers and deteriorating environmental hygiene conditions due to physical distancing and appeals to stay at *home* [15].

The age group of children directly affected by the arrival of the Covid-19 pandemic is children aged 6-23 months, considering that the age group of less than 2 years has a close relationship with the pandemic that has been going on for the past 2 years, starting from the first quarter of 2020. In addition, research with the theme of stunting during the Covid-19 pandemic has not been carried out by many other researchers. Therefore, researchers are motivated to conduct research on the incidence of stunting during the Covid-19 pandemic in Balangan Regency.

The purpose of this study was to determine the effect of early breastfeeding initiation, exclusive breastfeeding and infections regarding to stunting during the Covid-19 pandemic.

2 Methods

The design used in this study was *case-control*. The location of this study was in 6 villages in the stunting focus location in 2 sub-districts in Balangan Regency. The location was determined based on the high incidences of stunting, there are Guha Village, Bungur Village and Teluk Mesjid Village in Batumandi Sub-district, then Kusambi Hulu Village,

Tampang Village and Mundar Village in Lampihong Sub-district. The research period used for data collection was one full month, starting from 1st to 30th of June 2022.

The population in this study is all children aged 6-23 months who are within the scope of the research location. The rationale for selecting population criteria is that this age group has been directly affected by the Covid-19 pandemic over the past 2 years. Then, based on this population, some children aged 6-23 months were chosen as the sample to be studied. Referring to the research design used which is *case control* where there are exposed and unexposed groups, the research sample is divided into 2 groups, the *case* group and the *control* group. Samples included in the *case* group were children aged 6-23 months who were stunted, namely having a body length based on a *z-score of* -3 SD to -2 SD and samples included in the *control* group were children aged 6-23 months who were normal, namely having a body length based on a *z-score of* -2 SD to +3 SD.

In this study, the ratio of the number of samples between the *case* group and the *control* group was 1:2. Sampling was carried out using *simple random sampling* technique using a random number generator software. Sampling took into account several criteria: have settled for at least 3 months in the area, owns a KIA/KMS book, mothers of toddlers have received the second dose of Covid-19 vaccination, mothers of toddlers are willing to comply with health protocols. Before sampling, a pairing was first carried out, that means when getting one *case* sample, it then proceeds to randomize two *control* samples that have similar characteristics or are similar to the *case* sample in the form of same gender and age.

The data collected from each variable is primary data taken directly from the sample. Independent variables studied were early breastfeeding initiation, exclusive breastfeeding and infectious diseases on children. The dependent variable was the incidence of stunting in children aged 6-23 months.

Early breastfeeding initiation is the practice of giving breast milk to babies from the time the baby is born up to 1 hour, the category of results is if the baby from birth is immediately given breast milk up to an hour, then it is categorized as early breastfeeding initiation and if the baby from birth is not immediately given breast milk or breastfeeding is not up to 1 hour then it is categorized as not early breastfeeding initiation. Exclusive breastfeeding is the provision of breast milk to infants up to 6 months of age without being given any food or drink, the result category is if the baby up to 6 months of age is only given breast milk without being given any food or drink, it is categorized as exclusive breastfeeding and if the baby up to 6 months of age is not given breast milk or before the child is 6 months old, it is categorized as not exclusive breastfeeding. Infectious disease in children is a history of infectious disease caused by exposure to pathogens that the child has suffered during the last 3 months, the result category is if the child has a history of suffering from an infectious disease during the last three months then it is categorized as having a history of infectious disease and if the child has no history of suffering from an infectious disease during the last 3 months then it is categorized as having no history of infectious disease. While the incidence of stunting in children aged 6-23 months is the result of anthropometric measurements, namely body length / child age using Z-Score and the category of results is stunting if it has a body length based on a *z-score of* -3 SD to -2 SD and not stunting if it has a body length based on a *z-score of* -2 SD to +3 SD.

The researcher has also considered the presence of confounding variables such as maternal education and environmental sanitation that have a relationship with the independent and dependent variables based on the results of other studies. Data from maternal education and environmental sanitation variables were measured simultaneously with the measurement of the main research variables.

Data collection in the *case* group and *control* group was equalized, namely independent variable data measured by direct interview with the mother using a questionnaire

instrument. While the dependent variable data was measured by measuring the child's body length using an *infantometer* instrument with an accuracy of 0.1 cm.

Researchers have also considered the possibility of bias and confounding in the research results. So, efforts were made to overcome this, namely randomizing the sample properly and correctly, using valid and reliable measuring instruments that have been widely used by other researchers and then retesting their validity and reliability and conducting multivariate analysis.

Determination of the sample size studied using the calculation of the sample size formula for *case-control studies* by Lemeshow [16], The sample size was calculated using the sample size formula for case-control studies by Lemeshow, then additional sample considerations were made, namely efforts to anticipate *loss to follow up* (*drop out*) in a population estimated at 10%, so 22 samples were obtained. So, the *case* group sample was 22 stunted children aged 6-23 months and the *control* group was 44 normal children aged 6-23 months, so the total sample between the *case* and *control* groups was 66 children aged 6-23 months.

Statistical analysis carried out includes univariate analysis using frequency distribution, bivariate analysis using *chi square* test or *fisher's exact* test as an alternative if the *chi square test* does not meet the requirements and multivariate analysis using binary logistic regression test assisted by SPSS version 23 *software*. Researchers always *double check* each research instrument in an effort to avoid incomplete or missing data.

This study has been declared ethically sound by the research ethics committee of the Faculty of Medicine, Sebelas Maret University number: 37/UN27.06.11/KEP/EC/2022.

3 Results and discussion

3.1 Results

The research data of each sample in each group have been checked for eligibility and completeness of data and confirmed to have met the criteria and requirements described in the method. Then, univariate, bivariate and multivariate statistical analyses were conducted.

The samples analyzed were in accordance with the total sample planned for the study, namely 22 samples in the *case* group and 44 samples in the *control* group, so the total sample analyzed was 66 children aged 6-23 months.

3.1.1 Univariate Analysis

The data analysis (Table 1) shows that most of the stunted and normal children were female (59.1%). Most of the stunted and normal children were aged 13-23 months (90.9%). Most of the stunted and normal children had a history of birth length more than 48 cm or normal (86.4%) and (95.5%).

Table 1 shows that most of the stunted and normal children had mothers aged 20-35 years (86.4%). Most of the stunted and normal children had mothers who were normal height (90.9%) and (97.7%). Stunted children had mothers whose education was equally balanced between not graduating from high school and graduating from high school (50%), compared to normal children who mostly had mothers whose education graduated from high school (68.2%). Most stunted children belonged to families with bad environmental sanitation (63.6%), while normal children mostly belonged to families with good environmental sanitation (81.8%).

In addition, table 1 also shows that most stunted children at birth did not receive early initiation of breastfeeding by their mothers (63.6%), while normal children at birth received

early initiation of breastfeeding by their mothers (79.5%). Most stunted children were not exclusively breastfed by their mothers (54.5%), while most normal children were exclusively breastfed by their mothers (77.3%). Most stunted children had a history of infectious disease during the last 3 months (86.4%) while most normal children did not have a history of infectious disease during the last 3 months (65.9%).

Table 1. Characteristic of study participants.

	Case ***(Stunting)***	**Control** ***(Normal)***
	n (%)	**n (%)**
Independent Variable		
Child Nutrition Status	22 (33.3%)	44 (66.7%)
Dependent Variable		
Child Gender		
Male	9 (40.9%)	18 (40.9%)
Female	13 (59.1%)	26 (59.1%)
Child's Age		
6-12 Months	2 (9.1%)	4 (9.1%)
13-23 Months	20 (90.9%)	40 (90.9%)
Child Birth Length		
Short (< 48 cm)	3 (13.6%)	2 (4.5%)
Normal (≥ 48 cm)	19 (86.4%)	42 (95.5%)
Mother's Age		
< 20 & > 35 years	3 (13.6%)	6 (13.6%)
20-35 years	19 (86.4%)	38 (86.4%)
Mother's Height		
Short Mothers (< 145 cm)	2 (9.1%)	1 (2.3%)
Normal Height (≥ 145 cm)	20 (90.9%)	43 (97.7%)
Mother's Education		
< High School	11 (50%)	14 (31.8%)
≥ High School	11 (50%)	30 (68.2%)
Environmental Sanitation		
Bad	14 (63.6%)	8 (18.2%)
Good	8 (36.4%)	36 (81.8%)
Early Breastfeeding Initiation		
No Early Breastfeeding	14 (63.6%)	9 (20.5%)
Early Breastfeeding Initiated	8 (36.4%)	35 (79.5%)
Exclusive Breastfeeding		
Not Exclusively Breastfed	12 (54.5%)	10 (22.7%)
Exclusive Breastfeeding	10 (45.5%)	34 (77.3%)
Child Infectious Diseases		
History	19 (86.4%)	15 (34.1%)
No History	3 (13.6%)	29 (65.9%)

Based on the number of stunted children who did not receive early breastfeeding initiation at birth and did not receive exclusive breastfeeding by their mothers and had a history of suffering from infectious diseases during the last 3 months. Researchers conducted a deeper exploration of why this happened.

It can be seen from (Figure 1) that children who do not receive early breastfeeding initiation in stunted children and normal children are generally caused by the lack of production of breast milk that is first produced shortly after childbirth (56.5%) such as small quantity of milk or no milk at all.

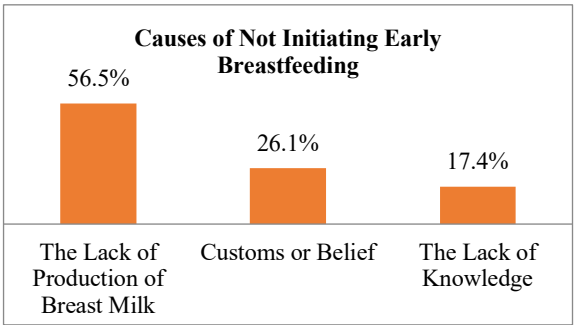

Fig. 1. Causes of not initiating early breastfeeding.

It is shown in (Figure 2) that children who are not exclusively breastfed in stunted children and normal children are generally caused by the lack of milk production itself (68.2%) as well as what happens in early breastfeeding initiation, namely the quantity of milk that is small or milk that does not come out at all.

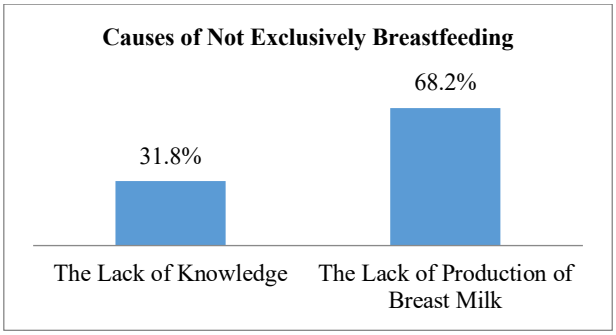

Fig. 2. Causes of not exclusively breastfeeding.

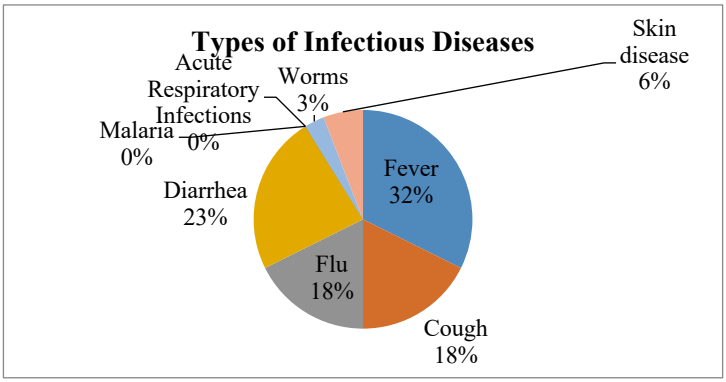

Fig. 3. Types of infectious diseases.

As shown in (Figure 3), the type of infectious disease suffered by children during the last 3 months in stunted children and normal children is generally fever (32%), diarrhea (23% and flu (18%).

3.1.2 Bivariate Analysis

From the results of the bivariate analysis presented in (Table 2) it can be seen that there is no significant influence between the age of the child (age 6-12 months), child birth length (short < 48cm), the sex of the child (males), the age of the mother (less than 20 years old and more than 35 years old) and the education of the mother (did not graduate from high school) with the incidence of stunting during the Covid-19 pandemic in Balangan Regency as evidenced by the value of p > 0.05. The variables of child age, child birth length, mother's age and mother's height do not meet the criteria and requirements of the *chi square* test because there is an *expected count* value that is less than 5 by 20%. So, an alternative statistical test is used which is the *fisher's exact* test.

Table 2. Bivariate analysis result of stunting.

Variables	p	OR (95% CI)
Child's Age		
6-12 Months	1.000[a]	1.000 (0.169 – 5.931)
Child Birth Length		
Short (< 48 cm)	0.323[a]	3.316 (0.511 – 21.502)
Child Gender		
Male	1.000	1,000 (0.353 – 2.832)
Mother's Age		
< 20 & ≥ 35 years	1.000[a]	1.000 (0.225 – 4.443)
Mother's Height		
Short (< 145 cm)	0.256[a]	4.300 (0.368 – 50.249)
Mother's Education		
< High School	0.243	2.143 (0.750 – 6.119)
Environmental Sanitation		
Bad	0.001*	7.875 (2.473 – 25.076)
Early Breastfeeding Initiation		
No Early Breastfeeding	0.001*	6.806 (2.185 – 21.201)
Exclusive breastfeeding		
Not Exclusively Breastfed	0.021*	4.080 (1.363 – 12.209)
Infectious Diseases		
Has a history	0.000*	12.244 (3.118 – 48.086)

*) Significant: p < 0.05
p: *Chi Square Test*
a: *Fisher's Exact Test*

Poor environmental sanitation has a significant effect on the incidence of stunting during the Covid-19 pandemic in Balangan Regency as evidenced by the value of p 0.001 < 0.05, this also indicates that toddlers have the potential of 7.8 times more to become stunted if they live in an environment with poor sanitation. Children who did not receive early breastfeeding initiation at birth had a significant effect on the incidence of stunting during the Covid-19 pandemic in Balangan Regency as evidenced by the value of p 0.001 < 0.05, while showing that children have a potential of 6.8 times more to become stunted if they do not receive early breastfeeding initiation at birth (Table 2).

Children who are not exclusively breastfed have a significant effect on the incidence of stunting during the Covid-19 pandemic in Balangan Regency as evidenced by the value of p 0.021 < 0.05, indicating that children have a potential of 4 times more to become stunted if they do not get early breastfeeding initiation at birth. Children who have a history of suffering from infectious diseases during the last 3 months also have a significant effect on the incidence of stunting during the Covid-19 pandemic in Balangan Regency as evidenced by the value of p 0.000 < 0.05, this indicates that children have a potential of 12.2 times more to become stunted if they have a history of suffering from infectious diseases (Table 2).

3.1.2 Multivariate Analysis

The multivariate analysis (Table 3) was carried out in stages with 3 models using a stepwise model, namely models 1, 2, and 3. This modelling aims to find a suitable binary logistic regression test model, then the variables are removed in stages. In the first modelling, all variables are included in the analysis.

In the second model, the variables are child gender, mother's age, mother's education, and exclusive breastfeeding. This is done because these variables have very large p-values > 0.55. Then, in the third model, the variables are child birth length, and mother's height. This is done because these variables have large p-values > 0.025.

Table 3 shows that the variables of child age, child birth length, child sex, mother's age, mother's height, mother's education and environmental sanitation were included as confounding variables because after the inclusion of these variables in the binary logistic regression test, there was a considerable change in the aOR (*Adjusted Odds Ratio*) value (> 20%) in the three main independent variables.

Table 3. Stepwise Model: Multivariate analysis result of stunting.

Variables	Model 1		Model 2		Model 3	
	p	aOR (95% CI)	p	aOR (95% CI)	p	aOR (95% CI)
Child's Age						
6-12 Months	0.204	0.129 (0.006 – 3.031)	0.160	0.139 (0.009 – 2.183)	0.246	0.260 (0.027 – 2.531)
Child Birth Length						
Short (< 48 cm)	0.391	3.031 (0.240 – 38.286)	0.304	3.290 (0.340 – 31.888)		

Child Gender						
Male	0.645	0.560 (0.149 – 3.250)				
Mother's Age						
< 20 & ≥ 35 years	0.957	1.061 (0.125 – 8.991)				
Mother's Height						
Short (< 145 cm)	0.569	3.041 (0.066 – 139.786)	0.487	3.211 (0.119 – 86.270)		
Mother's Education						
< High School	0.985	0.985 (0.190 – 5.116)				
Environmental Sanitation						
Bad	0.059	4.490 (0.945 – 21.323)	0.046*	3.878 (1.024 – 14.690)	0.048*	3.768 (1.012 – 14.031)
Early Breastfeeding Initiation						
No Early Breastfeeding	0.068	6.811 (0.865 – 53.604)	0.051	3.939 (0.996 – 15.568)	0.044*	3.997 (0.846 – 49.510)
Exclusive Breastfeeding						
Not Exclusively Breastfed	0.440	0.451 (0.059 – 3.414)				
Infectious Diseases						
Has a history	0.033*	6.643 (1.165 – 37.862)	0.027*	6.209 (1.236 – 31.201)	0.023*	5.959 (1.277 – 27.804)
Hosmer and Lemeshow Test	0.565		0.140		0.045	
-2 Log Likelihood	55.257		55.542		57.838	
Nagelkerke R Square	0.491		0.487		0.455	

*) Significant: $p < 0.05$
p: *Binary Logistic Regression*
Model 1: Include all the Variable
Model 2: Exclude Variables Child Gender, Mother's Age, Mother's Education, and Exclusive Breastfeeding
Model 3: Exclude Variables Child, Birth Length and Mother's Height

After doing the stepwise model, the most suitable model was found, which can be seen in (Table 4). Table 4 shows the final model on the most suitable binary logistic regression multivariate test. Then, it can be seen from (Table 3) that infectious diseases are the most

influential variable on the incidence of stunting during the Covid-19 pandemic in Balangan Regency, which is indicated by an aOR value of 5.538.

The final model multivariate analysis (Table 4) carried out has met the requirements of the binary logistic regression test and the model is appropriate or fit as shown in (Table 4) the value of -2 log likelihood < chi square table (59.206 < 81.381). The *chi square table* value is obtained from the calculation of DF = N-K-1 (66-3-1 = 62). N is the total number of samples and K is the number of variables analyzed. Then the calculated number is matched on the *table chi square* sheet. In addition, the analysis results show a Nagelkerke r square value of 0.435, which means that the independent variable is able to explain the dependent variable by 43.5%, the remaining 56.5% is determined by other variables that are not included in the model.

Table 4. Final Model: Multivariate analysis result of stunting.

Variables	p	aOR (95% CI)
Environmental Sanitation		
Bad	0.058	3.471 (0.956 – 12.600)
Early Breastfeeding Initiation		
No Early Breastfeeding	0.072	3.225 (0.900 – 11.561)
Infectious Diseases		
Has a history	0.026*	5.538 (1.225 – 25.046)
-2 Log Likelihood	59.206	
Nagelkerke R Square	0.435	

*) Significant: $p < 0.05$
p: *Binary Logistic Regression*

3.2 Discussion

Based on the results of the *chi square* test, early breastfeeding initiation has a significant effect on the occurrence of stunting in children aged 6-23 months during the Covid-19 pandemic. This shows that children who are stunted during the Covid-19 pandemic are caused by children not getting early breastfeeding initiation from birth up to 1 hour after. Children who did not receive early breastfeeding initiation during the Covid-19 pandemic had a risk of 4 times to become stunted. Relevant to other studies which suggest that there is a significant relationship between early breastfeeding initiation and stunting in children [17-19]. Children who are not given early breastfeeding initiation are mostly caused by a lack of milk production. Milk produced by the mother and then released for the first time to be given to the baby is called colostrum, this colostrum is very beneficial for babies such as providing immunity to be stronger against exposure to disease infections and supporting the improvement of body tissues, for example, providing a coating on the baby's intestines [20].

Exclusive breastfeeding has a significant effect on the occurrence of stunting in children aged 6-23 months during the Covid-19 pandemic. This shows that children who are stunted during the Covid-19 pandemic are caused by children not being given exclusive breastfeeding for 6 full months. Children who are not exclusively breastfed during the Covid-19 pandemic have a risk of 4 times to become stunted. In line with the results of other studies which state that stunted children are caused by not being given exclusive

breastfeeding for 6 [21, 14, 22]. Non-exclusive breastfeeding is generally caused by a lack of breast milk production such as mothers who cannot produce breast milk at all or mothers who produce little milk. Therefore, mothers are worried that their children will lack nutrition, so they give them food and drinks other than breast milk such as formula milk and soft fruits. In contrast, according to other researchers who refer to the theory that from the time a child is born until the child is 6 months old, it is forbidden to give any food or drink, only breast milk can be given because breast milk already contains the nutrients needed by children until the child is 6 months old [23, 24]. Other researchers also revealed that if a child who is not yet 6 months old is given food or drink other than breast milk, it will cause problems in the digestive system so that the child becomes stunted [25].

It is optimal to give food or drink when the child has passed the age of 6 months. Based on other studies, children who are not yet 6 months old are not recommended to be given food or drinks other than breast milk, but the food and drinks given will work optimally if given when the child is at least 6 months old [26].

Infectious diseases have a significant effect on the occurrence of stunting in children aged 6-23 months during the Covid-19 pandemic. This shows that children who are stunted during the Covid-19 pandemic are caused by infectious diseases suffered by children. Children who suffer from infectious diseases during the Covid-19 pandemic have a risk of 12.2 times to become stunted. In line with the results of other studies which state that infectious diseases are significantly associated with the occurrence of stunting in children [21, 19, 27]. Generally, the infectious disease suffered by children during the last 3 months is fever. When children suffer from illnesses caused by infectious diseases such as fever and diarrhea, it will cause problems, namely children not wanting to eat so that children lack nutritional intake then exacerbated by continuous body catabolism which in turn inhibits children's growth [28]. The occurrence of growth inhibition in children triggered by loss of appetite, if this happens continuously, it can trigger children to become stunted due to lack of nutritional intake [29, 14].

The presence of confounding variables can be detected by looking at whether the variable has a relationship with the dependent variable or based on the results of other studies and can also be seen from changes in the aOR (*Adjusted Odds Ratio*) value of >10-20% in the main independent variable of the study [30]. After the inclusion of the variables of child age, child birth length, child gender, mother's age, mother's height, mother's education and environmental sanitation into the multivariate analysis. Then there was a considerable change in the OR (*Odds Ratio*) value (>20%). In addition, the results of the binary logistic regression analysis present that there are other possible variables that affect the occurrence of stunting during the Covid-19 pandemic by 56.5%. Researchers believe these variables are maternal knowledge and education about child nutrition. Relevant to the results of other studies which state that mothers who have less knowledge and education can increase the risk of stunting in children [33]. This is because if mothers do not have knowledge due to lack of education about child nutrition, there will be errors in the parenting given to children such as the practice of early breastfeeding initiation, exclusive breastfeeding and how to prevent exposure to infectious diseases in children [31].

Another study mentioned that mother's education is significantly associated with stunting in children [31]. Mother's education in this case is closely related to the breadth of knowledge in terms of education provided by health workers regarding nutrition and child health. The higher the mother's education is always accompanied by high knowledge because it is easier to capture and understand information conveyed by others so that knowledge will be better [32].

Other studies suggest that environmental sanitation has a strong association with the incidence of stunting [29, 19]. Poor environmental sanitation is closely related to subsequent impacts, such as increased incidence of infectious diseases that stem from

exposure to pathogens including viruses and bacteria. If environmental sanitation can be controlled, then infectious diseases can be prevented. Environmental sanitation control during the Covid-19 pandemic is certainly hampered because people cannot carry out social activities such as working together to clean the surrounding environment because the government encourages people to keep their distance and stay at home. In addition, people are worried that crowds will trigger the spread of the Covid-19 virus.

The most influential independent variable on the dependent variable can be seen from the magnitude of the OR (*Odds Ratio*) value [16, 34]. So, based on the results of the binary logistic regression test, infectious diseases are the variables that have the most dominant influence on the incidence of stunting during the Covid-19 pandemic in Balangan Regency.

Of course, this study has limitations. The limitation in this study is the control of confounding variables. The confounding variables were mother's knowledge and nutrition education that should have been studied and included in the study, but were not done due to considerations that have been studied by other researchers and allow information bias due to too many questions contained in the questionnaire instrument.

4 Conclusion

Children who do not receive early breastfeeding initiation during the Covid-19 pandemic have a 6.8times more potential to become stunted. Children who are not exclusively breastfed during the Covid-19 pandemic have 4 times more potential to become stunted. Children who have a history of infectious diseases in the last 3 months have a potential of 12.2 times more to become stunted. The incidence of stunting during the Covid-19 pandemic is dominantly influenced by the presence of infectious diseases suffered by children.

Researchers provide advice to relevant agencies, in this case the Balangan Regency Health Office as a solution to solving the stunting problem, namely more intensively providing education and practice on how to launch breast milk production to mothers who have problems with breast milk production. Then, map early potential exposure to infectious diseases that can attack children and slowly reactivate community activities to work together to routinely clean the surrounding environment but still pay attention to health protocols and further improve the immunization program for children.

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References

1. World Health Organization, *Levels and Trends in Child Malnutrition, UNICEF/WHO/ The World Bank Group Joint Child Malnutrition Estimates, Key findings of the 2020 edition*, Washington DC, (2020)
2. World Health Organization, *Levels and trends in child malnutrition, UNICEF/WHO/ The World Bank Group Joint Child Malnutrition Estimates, Key findings of the 2021 edition*, Geneva, (2021)
3. 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*, Geneva, (2006)
4. Kementerian Kesehatan Republik Indonesia, *Hasil Utama Riset Kesehatan Dasar*, Badan Penelitian dan Pengembangan Kesehatan *(Main Results of Basic Health Research, Agency for Health Research and Development)*, Jakarta, (2018)

5. Dinas Kesehatan Provinsi Kalimantan Selatan, *Profil Kesehatan Provinsi Kalimantan Selatan Tahun 2019 (South Kalimantan Province Health Profile 2019)*, Pemerintah Provinsi Kalimantan Selatan, Banjarmasin, (2019)
6. Dinas Kesehatan Provinsi Kalimantan Selatan, *Profil Kesehatan Provinsi Kalimantan Selatan Tahun 2020 (South Kalimantan Province Health Profile 2020)*, Pemerintah Provinsi Kalimantan Selatan, Banjarmasin, (2020)
7. Kementerian Hukum dan Hak Asasi Manusia Republik Indonesia, *Rencana Pembangunan Jangka Menengah Nasional Tahun 2020-2024 (National Mid-Term Development Plan 2020-2024)*, Jakarta, (2020)
8. Badan Perencanaan Pembangunan Daerah Provinsi Kalimantan Selatan, *Rencana Pembangunan Jangka Menengah Daerah (RPJMD) Provinsi Kalimantan Selatan Tahun 2016-2021 (South Kalimantan Province Medium Term Development Plan 2016-2021)*, Banjarmasin, (2016)
9. Kementerian Kesehatan Republik Indonesia, 1 dari 3 Balita Indonesia Derita Stunting (1 of 3 Indonesian Toddlers Suffers from Stunting), Direktorat Pencegahan dan Pengendalian Penyakit Tidak Menular, Jakarta, (2018)
10. Kementerian Kesehatan Republik Indonesia, Kualitas Manusia Ditentukan Pada 1000 Hari Pertama Kehidupannya (Human Qualities Are Determined in The First 1000 Days of Life), Jakarta, (2017)
11. Kementerian Kesehatan Republik Indonesia, *Peraturan Menteri Kesehatan Republik Indonesia Nomor 2 Tahun 2020 Tentang Standar Antropometri Anak (Regulation of the Minister of Health of the Republic of Indonesia Number 2 of 2020 concerning Child Anthropometry Standards)*, Indonesia, (2020)
12. WHO Multicentre Growth Reference Study Group, Acta Paediatrica., **95 (S450),** 7-15, (2006)
13. Sutarto, D. Mayasari, R. Indriyani, Stunting, *Faktor Resiko dan Pencegahannya*, J. Agromedicine, **5**, 243–243, (2018)
13. Sutarto, D. Mayasari, R. Indriyani, Stunting, J. Agromedicine, **5**, 243–243, (2018)
14. R. A. Damayanti, L. Muniroh, F. Farapti, *Perbedaan Tingkat Kecukupan Zat Gizi dan Riwayat Pemberian ASI Eksklusif Pada Balita Stunting dan Non Stunting*, Media Gizi Indones., **11**, 61, (2016)
14. R. A. Damayanti, L. Muniroh, F. Farapti, Media Gizi Indones., **11**, 61, (2016)
15. N. Akseer, G. Kandru, E. C. Keats, Z. A. Bhutta, Am. J. Clin. Nutr., **112**, 251–256, (2020)
16. S. Lemeshow, D. W. Hosmer Jr, J. Klar, S. K. Lwanga, *Besar Sampel Dalam Penelitian Kesehatan (Sample Size in Health Research)*, Gadjah Mada University Press, Yogyakarta, (1997)
17. N. N. Atyeo, T. D. Frank, E. F. Vail, W. A. L. Sperduto, D. L. Boyd, J. Hum. Lact., **33 (4)**, 781–789 (2017)
18. M. R. Permadi, D. Hanim, K. Kusnandar, D. Indarto, Penelit. Gizi dan Makanan (The J. Nutr. Food Res., **39 (1)**, 9–14, (2017)
19. T. Beal, A. Tumilowicz, A. Sutrisna, D. Izwardy, L. M, Matern. Child Nutr., **14 (4)**:e12617, (2018)
20. N. Ruaida, Glob. Heal. Sci., **3 (2),** 139–151 (2018)
21. W. Lestari, A. Margawati, Z. Rahfiludin, J. Gizi Indones. (The Indones. J. Nutr **3 (1)**, 37–45 (2014)
22. H. Torlesse, A. A. Cronin, S. K. Sebayang, R. Nandy, BMC Public Health, **16 (669),** 1–11, (2016)
23. S. Almatsier, *Prinsip Dasar Ilmu Gizi (Basic Principles of Nutrition)*, PT Gramedia Pustaka Utama, Jakarta, (2009)
24. Kementerian Kesehatan Republik Indonesia, *Situasi dan Analisis ASI EKSLUSIF*

(Exclusive Breastfeeding Situation and Analysis), Pusat Data dan Informasi Kementerian Kesehatan Republik Indonesia, Jakarta, (2014)
25. L. S. Adair, D. K. Guilkey, J. Nutr., **127**, 314–320, (1997)
26. R. E. Black, L. H. Allen, Z. A. Bhutta, L. E. Caulfield, M. de Onis, M. Ezzati, C. Mathers, J. Rivera, The Lancet, **371 (9608)**, 243–260 (2008)
27. I. A. Dewi, K. T. Adhi, Archive of Community Health **3 (1)**, 36–46 (2014)
28. Departement of Technique Action centre la FAIM-Fr, *Interactions of: Malnutrition, Water Sanitation and Hygiene, Infections*, Action Faim, 1–47, (2007)
29. C. P. Stewart, L. Iannotti, K. G. Dewey, K. F. Michaelsen, A. W. Onyango, Matern. Child Nutr., **9 (suppl 2)**, 27–45 (2013)
30. A. N. Probandari, E. P. Pamungkasari, R. P. Febrinasari, Sumardiyono, V. Widyaningsih, *Metode Penelitian Kuantitatif: Strategi Menulis Proposal Penelitian Kesehatan (Quantitative Research Methods: Strategies for Writing Health Research Proposals)*, UNS Press, Surakarta, (2020)
31. A. Margawati, A. M. Astuti, J. Gizi Indones **6 (2)**, 82–89 (2018)
32. S. Notoatmodjo, *Promosi Kesehatan Teori dan Aplikasinya (Health Promotion Theory and Its Application),* Rineka Cipta, Jakarta, (2005)
33. K. Ni'mah, S. R. Nadhiroh, Media Gizi Indones., **10**, 13–19 (2015)
34. I. Masturoh, A. Nauri, *Metodologi Penelitian Kesehatan (Health Research Methodology)*, Pusat Pendidikan Sumber Daya Manusia Kesehatan Kementerian Kesehatan Republik Indonesia, Jakarta, (2018)