Maternal Efforts to Optimize the First 1000 Days of Life: Is It Successful to Reduce Stunting in Indonesia?

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Abstract

The national health survey shows that one-third of children under five years old in Indonesia suffer stunting. This study investigates how to break the cycle of stunting using community – based health and nutrition approach. The focus of this study is to examine the effectiveness of maternal health behavior efforts within the first 1000 days of life-related to stunting using Sentinel Data 2017. The results found that the percentage of stunting in children aged 12 months or less was almost 3 times of wasting and almost 2 times of underweight. Exclusive breastfeeding knowledge of mother and children postnatal care visitation complete were significantly associated with stunting. In addition, children from a household with open defecation behavior were also at increased risk of stunting. Improving maternal health knowledge and health behavior, as well as family and community, are strongly advised to decrease stunting prevalence in Indonesia.

A. Introduction

Pregnancy to 24 months post-partum is the vulnerable period to face health problem exposures. These are leading to maternal and children mortality which mostly occurred in the first month post-delivery[1,2]. Providing the qualified health services and ensuring both mother and children easily access them at each period within the first 1000 days of life (prenatal, childbirth, and postpartum) are several ways to prevent those matters[3].

Health assessments, early detection of health problems or treatment are several advantages that can be obtained if they truly use those health services well. In addition, pregnant women also obtain several appropriate information related to pregnancy, such as physically alteration during pregnancy, Iron and Folic Acid (IFA) or food intake recommendation, delivery preparation, Initiative Breastfeeding (IBF), Exclusive Breastfeeding (EBF), post-partum and child care, child growth and development, food complementary feeding, and pregnancy myths in community[4,5,6,7]. This benefit should be supported by their awareness and commitment to change behavior as visiting the healthcare regularly at each period and implement health practitioner's advice to improve their health.

Stunting is one of the progression effects of adverse pregnancy outcomes that might be determined by unhealthy behaviors during pregnancy and it can be inherited intergenerationally[8,9,10,11,12,13]. Based on a study conducted in 2013 more than one of three children (37.2%) suffer it. Moreover, half of the provinces have a high prevalence, mostly located in Eastern Indonesia (19 of 34). In contrast, 83.5% of pregnant women in Indonesia have visited healthcare to do Antenatal Care (ANC)[14]. Stunting develops within the first 1000 days of life and it is more likely being irreversible in less than 5 years of age[15,16]. Although the stunting children still have a chance to catch up growth become fully recovered, improving maternal health at the beginning of pregnancy should be the main concern[17,18]. Thus, breaking the cycle of stunting by improving health behavior of pregnant women is one of the ways. Additionally, it should be overcome by multisector supporting through a sensitive and specific approach. The Government of Indonesia sets a target decreasing 40% of stunting in 2025 [19].

This study aims to assess and observe pregnant women's efforts during pregnancy, delivery, and post-partum period related to children nutritional status. This study focuses on IFA consumption during pregnancy, ANC visitation, mother's knowledge related to ANC, EBF, IBF, and complementary feeding. Additionally, education class attendance, IBF and EBF practices, health facility utilization, open defecation, and hand soap washing behaviors in the family. These variables are controlled by both mother and children characteristics, such as mother's stature, pregnancy at risk, children age, and gender.

B. Methods

1. Data source

This cohort study was using the data of Sentinel study conducted by SurveyMETER and MCA-Indonesia. The Sentinel study was a population-based cohort study focused on maternal health and behavior during pregnancy of productive age women and children's health under 2 years old. The household environment was observed as well. The study was carried out from April 2017 –March 2018 and conducted into four waves. The study respondents were pregnant women and child under 2 years at each wave and followed until the end of the study. The datasets contained 4283 pregnant women and 10699 of children who lived in 100 villages within 11 Province in Indonesia (East Java, West Java, West Borneo, Central Borneo, South Sumatra, Maluku, Gorontalo, East Nusa Tenggara, West Nusa Tenggara, North Sulawesi, and West Sulawesi). All information obtained from the participants were recorded in Computer Assisted Personal Interviewing (CAPI) program.

The study focused on maternal efforts during pregnancy related to the nutritional health of the children after birth. The inclusion analysis is the pregnant women who enrolled at the first wave that delivered their child within the study period and completed the study until the last wave. The mother's health efforts that observed were Iron and Folic Acid (IFA) consumption during pregnancy, Antenatal Care

(ANC) and Postnatal Care (PNC) complete visitation, and health knowledge related to ANC, PNC, EBF, IBF, and complementary feeding. In addition, pregnancy and toddler class (*kelas ibu hamil dan kelas balita*) attendance, giving birth at a health facility; IBF and EBF practices, Open Defecation (OD) and hand soap washing behavior in the family were observed as well. The outcome variable was children nutritional status that assessed at the end of the study. The maternal characteristics (age, height, the risk of pregnancy age, occupation, MUAC, education), children characteristic (age and sex), and region of residence were used as controlled variables.

2. Anthropometric measurement

Anthropometric assessment for pregnant women, including height, body weight, and Middle Upper Arm Circumference (MUAC) were measured at the beginning of enrollment. Whereas for children length or height and body weight, were measured at the end of the study. Body weight measurement was taken by a SECA scale 876 series, digital weighing scale to the nearest 0.1 kg. Height and length measurement was taken using a SECA portable height measure 213 series and SECA 417 series with a precision 0.1 cm, respectively. Med line was used for upper arm circumference measurement with a precision 0.1 cm as well.

3. **Nutritional status**

The nutritional status of children was classified as stunting, wasting, and underweight. Stunting was identified as height-for-age Z-score (HAZ) < -2 Standard Deviation (SD) of the WHO Child Growth Standards median. Wasting was identified as weight-for-height Z-score (WHZ) <-2 SD and underweight were identified as weight-for-age Z-score (WAZ) <- 2 SD of the WHO Child Growth Standards median[20]. In this study, stunting and severe stunting were groupings in a categorize as well as underweight and wasted. Children z-score was calculated using WHO macros ado file packages for STATA.

4. Statistical analysis

The first part of analysis focused on the subject-descriptive characteristics, in general, and by region. Moreover, the association of independent variables and children nutritional status was analyzed descriptively using the chi-square test. The second part focused on regression test using logistic regression to examine possible determinants of children undernutrition related to the pregnant women's health behavior efforts during pregnancy while controlling other factors. The results were presented in robust Standard Error (SE), Adjusted Odds Ratio (AOR), and Confidence Interval (CI) with a 95% level of confidence. AOR >1 interpreted that the variables lead to a higher risk of stunting, underweight, or wasted occurrence. AOR <1 was represented as a protective variable to prevent undernutrition. Data analysis was performed using STATA 13.1

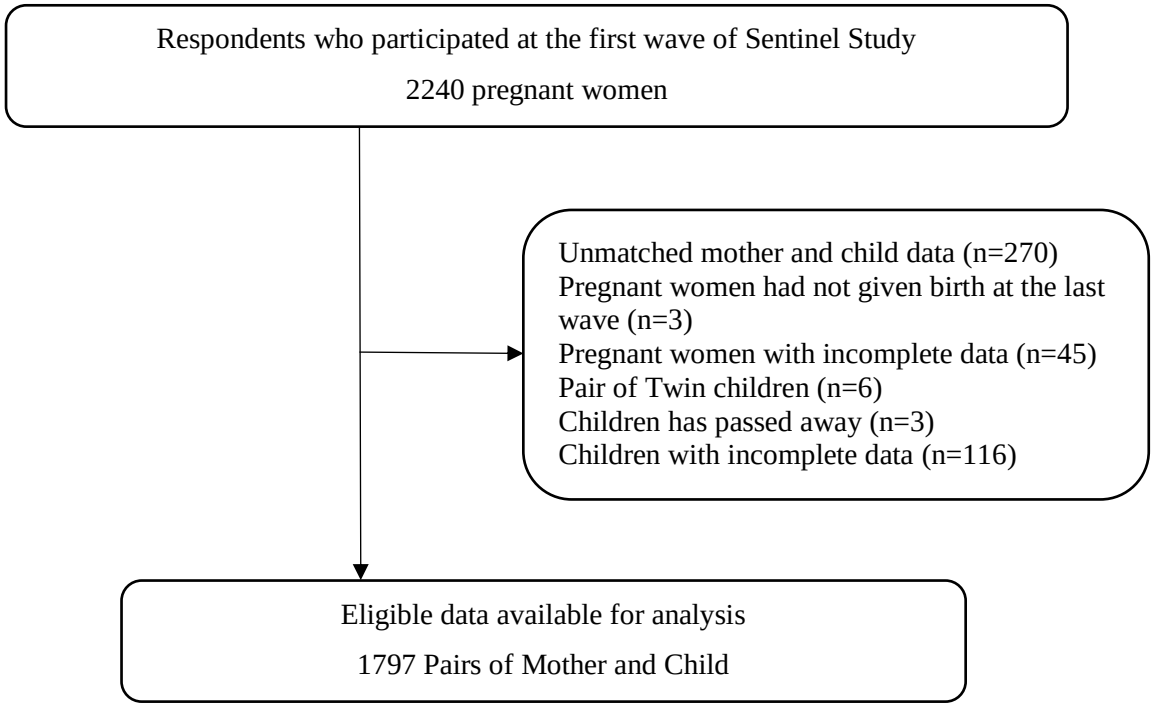

Figure 1. Study Participant's selection steps

C. Results

1. Mother Characteristics and Maternal Efforts

There were 2240 pregnant women enrolled at the beginning, yet only 75 % of them (1797 participants mother and child pairs) were selected as eligible respondents of this study. Most of the mothers are aged 25 – 34 years with child age for more than 6 months. The study found that the compliance of IFA consumption according to the recommendations was low (29.27%). The caregiver who had ever attended the toddler class (*kelas balita*) was low as well (4.56%). Additionally, it was only about one-third of mothers (31.79%) who practiced breastfeeding exclusively to their children. Moreover, the finding had shown that almost all households were not using the soap while washing their hands (hand soap washing behavior in family only 1.45%). The detail mother characteristics and maternal efforts are presented in Table 1.

Table 1. Mother Characteristics and Maternal Efforts

	%
Child age	
< 6 months	45.46
≥ 6 months	54.54
Child sex	
Boys	51.09
Girls	48.91
Mother age (years)	
15 – 24	30.38
25 – 34	47.52
≥35	22.09
Mother pregnancy at risk (age)	24.10
Mother as worker	21.70
Mother education < 6 years	36.00
Mother height <145 cm	9.79
Mother Mid-Upper Arm Circumference <23.5 cm	17.70
Iron consumption during pregnancy ≥90	29.27
Mother Antenatal Care visitation complete	93.77
Ever attended pregnancy class	31.39
Good Antenatal Care knowledge	95.99
Good Initiative Breastfeeding knowledge	77.52
Good Exclusive Breastfeeding knowledge	54.87
Good Complementary Feeding knowledge	75.46
Giving birth in health facilities	80.80
Initiative Breastfeeding Practice	68.67
Exclusive Breastfeeding Practice	31.78
Children with diarrhea history	17.47
Ever Attended toddler class (*kelas balita*)	4.56
Child postnatal care complete visitation	68.22
Open defecation behavior in family	34.56
Hand soap washing behavior in family	1.45
Region	
East Java and West Java	42.13
West Kalimantan, Central Kalimantan, and South Sumatra	19.31
Maluku, Gorontalo, West Nusa Tenggara, East Nusa Tenggara, North Sulawesi, and West Sulawesi	38.56
Total (N= 1797)	100

2. Regional Gap on Maternal Efforts

Table 2 presents the characteristics of participants based on their region. The chi-squared test showed that the mother's health behavior efforts were significantly different between the regions. In addition, education class attendance (pregnancy and toddler class), IFA consumptions during pregnancy, EBF practice, and hand soap washing behavior in family showed low proportion in all regions.

Table 2. Respondent characteristics based on regional place of residence

	Regional			Total (N=1797)
	East Java and West Java	West Kalimantan, Central Kalimantan, and South Sumatra	Maluku, Gorontalo, West Nusa Tenggara, East Nusa Tenggara, North Sulawesi, and West Sulawesi	
	%	%	%	%
Mother height <145 cm	9.25	10.95	9.81	9.79
Mother Mid-Upper Arm Circumference <23.5*	16.78	12.10	21.50	17.70
IFA consumption during pregnancy ≥90*	29.72	13.83	36.51	29.27
ANC complete visitation*	96.30	87.03	94.37	93.77
Ever attended pregnancy class*	34.21	43.80	22.08	31.39
Good antenatal care knowledge*	98.41	91.93	95.38	95.99
Good initiative breastfeeding knowledge*	77.28	71.47	80.81	77.52
Good exclusive breastfeeding knowledge*	49.67	47.26	64.36	54.87
Good complementary feeding knowledge*	75.83	65.71	79.94	75.46
Giving birth in health facility*	90.22	50.14	85.86	80.80
Initiative breasfeeding practice*	64.99	63.40	75.47	68.73
Exclusive breastfeeding practice*	26.16	18.44	44.59	31.78
Child with diarrhea history	17.04	17.58	17.89	17.47
Ever attended toddler class *	3.83	8.36	3.46	4.56
Postnatal care complete visitation*	87.32	53.60	54.69	68.22
Open defecation behavior in family*	23.78	49.57	38.82	34.56
Hand soap washing behavior in family*	2.25	0.29	1.15	1.45

*significant at <0.05

3. Children Nutritional Status

The percentage of stunting was 15.64%, almost two times almost 3 times of wasting and almost 2 times of underweight. The stunting was higher in boys than girls, but it was no significant difference. Additionally, the undernutrition prevalence was higher in the children who have a mother with poor nutritional status history at pregnancy. Moreover, the Eastern Indonesian region had the highest percentage of stunting, wasting, and underweight among other regions in Indonesia. Mother education, mother stature, and regional residences showed significant differences related to stunting (Table 3).

Table 3. Children nutritional status based on their characteristics

	Nutritional Status (%)			N
	Stunted	Underweight	Wasted	
All	15.64	9.07	6.07	1797
Child age (months)				
< 6	13.83	6.73	5.63	817
≥ 6	17.14	11.02	6.43	980
Child gender[b,c]				
Boys	16.56	10.78	7.30	918
Girls	14.68	7.28	4.78	879
Mother age (years)				
15 – 24	17.58	8.61	4.03	546
25 – 34	14.29	9.13	7.03	854
≥35	15.87	9.57	6.80	397
Mother pregnancy at risk				
Yes	18.01	11.09	6.70	433
No	14.88	8.43	5.87	1364
Mother as worker				
Yes	13.59	9.49	7.44	390
No	16.20	8.96	5.69	1407
Mother education (years) [a,c]				
> 6	14.35	8.35	5.22	1150
≤ 6	17.93	10.36	7.57	647
Mother height (cm) [a,b]				
≥ 145	14.44	8.39	6.05	1621
< 145	26.70	15.34	6.25	176
Mother Mid-Upper Arm Circumference (cm)[b]				
≥ 23.5	14.94	7.98	5.81	1479
< 23.5	18.87	14.15	7.23	318
Region[a,b]				
East java, West Java	10.44	6.08	5.02	757
West Kalimantan, Central Kalimantan and South Sumatra	14.99	10.09	5.48	347
Maluku, Gorontalo, West Nusa Tenggara, East Nusa Tenggara, North Sulawesi , West Sulawesi	21.65	11.83	7.50	693
Total	281	163	109	

Significant at <0.05 for (stunted)[a], (underweight)[b], and (wasted)[c]

4. Children Nutritional Status and Maternal Efforts

The stunting percentage was higher in mothers who had poor health behaviors during 1000 days of life, such as pre-and post-partum health care, health knowledge, and hygiene and sanitation (Table 4). However, several good efforts were demonstrated a higher percentage of stunting, such as IFA consumption ≥90 tablets during pregnancy, giving birth at health facilities, doing IBF and EBF practice, and also children who had no diarrhea history (Table 4).

Based on logistic regression test, the mothers who had good EBF knowledge (AOR: 0.74;95%CI: 0.56 – 0.99) and completed post-natal care attendance (AOR: 0.72; 95%CI: 0.54 – 0.96) were significantly 25 percent average less likely to have children with stunting, respectively. Moreover, open defecation behavior in the family was almost 2 times (AOR: 1.61; CI95%:1.21 – 2.14) more likely to increase

stunting in the children less than 12 months, significantly (Table 5). Almost half of stunting children had family practiced open defecation.

Table 4. The percentage of children nutritional status in terms of maternal efforts

	Nutritional Status (%)			N
	Stunted	Underweight	Wasted	
Pregnancy period				
Iron consumption during pregnancy				
≥ 90	16.35	8.75	6.46	526
< 90	15.34	9.21	5.90	1271
Antenatal care visitation complete				
Yes	15.19	8.84	6.17	1685
No	22.32	12.50	4.46	112
Ever attended pregnancy class				
Yes	14.01	7.80	6.74	564
No	16.38	9.65	5.76	1233
Antenatal care knowledge				
Good	15.25	8.93	6.03	1725
Poor	25.00	12.50	6.94	72
Initiative breastfeeding knowledge				
Good	15.43	9.55	5.96	1393
Poor	16.34	7.43	6.44	404
Exclusive breastfeeding knowledge[a]				
Good	14.10	9.63	5.88	986
Poor	17.51	8.38	6.29	811
Complementary feeding knowledge[a]				
Good	14.45	9.07	6.19	1356
Poor	19.27	9.07	5.67	441
Open defecation behavior in family[a]				
Yes	20.77	10.31	5.80	621
No	12.93	8.42	6.21	1176
Hand soap washing behavior in family[c]				
Yes	11.54	19.23	19.23	26
No	15.70	8.92	4.59	1771
Childbirth period				
Giving birth at a health facility				
Yes	15.63	8.82	6.20	1452
No	15.65	10.14	5.51	345
Initiative breastfeeding practice				
Yes	15.95	8.83	5.83	1235
No	14.95	9.61	6.58	562
Postnatal care visitation complete[a,b]				
Yes	13.05	7.91	5.71	1226
No	21.19	11.56	6.83	571
Postnatal period				
Exclusive breastfeeding practice				
Yes	16.40	9.81	6.30	571
No	15.53	8.73	5.95	1226
Children diarrhea history				
Yes	14.65	7.96	7.01	314
No	15.85	9.31	5.87	1483
Ever attended toddler class				
Yes	14.63	6.10	4.88	82
No	15.69	9.21	6.12	1715
Total	281	163	109	1797

Significant at <0.05 for (stunted)[a], (underweight)[b], (wasted)[c]

Two covariate variables were significantly associated with stunting as following: the children aged more than 6 months had 1.36 times more likely to suffer stunting than aged below 6 months (CI95%:1.04 – 1.78 Additionally, living in Eastern Indonesia Regional was more likely to suffer all undernutrition type than other regionals. (Table 5)

Table 5. Logistic regression result for maternal efforts related to children nutritional status

	Children nutritional status					
	Stunted		Underweight		Wasted	
	S.E	AOR (CI95%)	S.E	AOR (CI 95%)	S.E	AOR (CI 95%)
Independent variables						
Iron consumption during pregnancy ≥90	0.163	1.08 (0.80 – 1.45)	0.183	0.97 (0.67 – 1.41)	0.235	1.07 (0.70 – 1.65)
Antenatal care visitation complete	0.198	0.74 (0.43 – 1.25)	0.292	0.90 (0.48 – 1.70)	0.704	1.39 (0.52 – 3.75)
Ever attended pregnancy class	0.154	1.00 (0.74 – 1.35)	0.190	0.99 (0.68 – 1.44)	0.286	1.35 (0.89 – 2.04)
Good antenatal care knowledge	0.193	0.69 (0.40 – 1.19)	0.306	0.84 (0.41 – 1.71)	0.467	0.94 (0.35 – 2.49)
Good initiative breastfeeding knowledge	0.149	0.94 (0.69 – 1.28)	0.286	1.29 (0.84 – 1.99)	0.212	0.90 (0.56 – 1.42)
Good exclusive breastfeeding knowledge	0.110	0.74 (0.56 – 0.99)*	0.199	1.09 (0.76 – 1.56)	0.189	0.87 (0.57 – 1.33)
Good complementary feeding knowledge	0.133	0.83 (0.60 – 1.13)	0.211	0.99 (0.65 – 1.50)	0.283	1.08 (0.65 – 1.81)
Giving birth at health facility	0.260	1.38 (0.96 – 2.00)	0.239	1.02 (0.65 – 1.62)	0.280	1.03 (0.60 – 1.75)
Initiative Breastfeeding practice	0.148	1.01 (0.76 – 1.34)	0.150	0.83 (0.58 – 1.18)	0.179	0.83 (0.55 – 1.27)
Exclusive Breastfeeding practice	0.153	0.99 (0.73 – 1.34)	0.218	1.15 (0.80 – 1.67)	0.226	1.01 (0.66 – 1.57)
Child with diarrhea history	0.160	0.86 (0.60 – 1.24)	0.182	0.77 (0.49 – 1.23)	0.291	1.16 (0.71 – 1.90)
Ever attended toddler class	0.281	0.85 (0.44 – 1.62)	0.262	0.55 (0.21 – 1.40)	0.467	0.83 (0.28 – 2.50)
Postnatal care complete visitation	0.107	0.72 (0.54 – 0.96)*	0.151	0.82 (0.57 – 1.18)	0.206	0.93 (0.60 – 1.43)
Open defecation behavior in family	0.236	1.61 (1.21 – 2.14)**	0.174	1.01 (0.72 – 1.42)	0.174	0.80 (0.53 – 1.23)
Hand soap washing behavior in family	0.511	0.81 (0.24 – 2.79)	1.306	2.53 (0.92 – 6.97)	2.094	4.11 (1.51 – 11.16)**
Controlled variables						
Children age ≥ 6 months	0.188	1.36 (1.04 – 1.78)*	0.331	1.81 (1.26 – 2.59)**	0.241	1.14 (0.75 – 1.72)
Children gender (Girls)	0.116	0.83 (0.63 – 1.09)	0.108	0.62 (0.44 – 0.87)**	0.127	0.60 (0.40 – 0.91)*
Mother education <6 years	0.148	1.02 (0.77 – 1.35)	0.203	1.10 (0.77 – 1.58)	0.324	1.55 (1.03 – 2.33)*
Mother as worker	0.131	0.76 (0.55 – 1.07)	0.213	1.05 (0.70 – 1.56)	0.308	1.32 (0.83 – 2.08)
Mother height <145 cm	0.405	2.10 (1.44 – 3.06)***	0.463	2.00 (1.27 – 3.14)**	0.348	1.03 (0.56 – 2.02)
Have pregnancy high risk	0.171	1.12 (0.83 – 1.51)	0.241	1.26 (0.87 – 1.83)	0.258	1.07 (0.67 – 1.72)
Mother mid-upper arm circumference <23.5	0.188	1.11 (0.80 – 1.55)	0.347	1.79 (1.23 – 2.62)**	0.318	1.30 (0.81 – 2.10)
Dummy Borneo and Sumatra region	0.283	1.29 (0.84 – 1.97)	0.478	1.81 (1.09 – 3.01)*	0.370	1.20 (0.65 – 2.19)
Dummy East Indonesia region	0.377	2.17 (1.54 – 3.05)***	0.410	1.91 (1.26 – 2.90)**	0.380	1.62 (1.02 – 2.57)*
N	1797					

***significat at <0.001, **significant at <0.01, ***significant at <0.05 , S.E (Robust Standarad Error), Java as refference for region

D. Discussion

1. Stunting related to children and mother characteristics

Stunting has the biggest percentage among other types of undernutrition status in Indonesia. The national studies conducted in Indonesia in 2013 and 2017 showed the same pattern [14,3]. It indicated that undernutrition in Indonesia did not improve significantly although the number was decreased in 2017. Children height was a reflection of health and nutrition at the beginning of life as an embryo and demonstrated how they were conformed in the womb. Since height was the marker of the body, brain, and skils growth, mothers had to ensure their infants was on good health over time in order to reach a potential growth later on[21] .

The children aged more than 6 months were more likely to suffer stunting, as the previous study found that the prevalence of stunting increase by about 22% at age 6 – 24 months [22,23]. Another study, using Height for Age Difference (HAD) standard showed the height of children aged 0 – 60 months has decreased 70% and almost half of it (30%) occurred at age 2-5 years[24]. It indicated that the intervention at the first 1000 days if life were a critical period to obtain optimum growth. The children who stunted still have 2.5% chance to fully recovered after the first 24 months of life, yet if they lost this opportunity, it might difficult to catch up the growth[18].

Several studies also reported that boys tend to be stunted than girls although there was no significant difference [25,18,23]. It might be due to obtaining early feeding and mothers worry feeling about the breastmilk sufficiency for their boys. Additionally, boys had a higher risk to be immunodeficiency assaulted due to the asymptomatic infection related to stunting[26] .

The finding of this study shows that mother statue is the most predictor of stunting as well as the previous studies[9,10,11,12,13]. Mother stature had the role for genetic and phenotype arrangement of the embryo. It also became the determinant of Intrauterine Growth Restriction (IUGR) and Low Birth Weight (LBW), the predictors of children growth failure and stunting[13].

The prior studies showed that the duration of maternal education had significantly affected stunting[27,11]. In contrast, this study shows that no significant association between mother education and stunting. Actually, Education is an important factor affected mother interest and willingness to improve their knowledge, self-confidence, and awareness about health[28].

2. Stunted related to maternal health behaviors

Iron and Folic Acid consumption, ANC visitation complete, health knowledge (ANC, IBF, and complementary feeding), health facility utilization, IBF and EBF practices were not showing any significant results, only EBF knowledge and PNC visitation complete were associated to stunting. It

had been well recognized that breastfeeding was important and provided numerous benefits for children's health[29]. Breastmilk supplied all the necessary nutrients for the baby to obtain optimum growth and development[30]. WHO had recommended breastfeeding exclusively for 6 months, started directly after the baby was born[31]. EBF affected children immunity to prevent infection attacks, such as diarrhea, Acute Respiratory Infection (ARI), and fever that affected their nutritional status[32,33]. This study found that EBF knowledge was a protective variable for stunting. It means that increasing EBF knowledge was more likely to decrease stunting percentage for children less than 2 years of age. Previous studies showed that EBF were significantly associated with stunting as well[34]. So, it implicated that good knowledge supported the successfulness of EBF practice. However, only half of the pregnant women have a good knowledge of EBF based on these findings whereas it had been associated with positive breastfeeding outcomes[35]. Pregnant women should have obtained this knowledge while doing ANC visitation[5]. Pregnant women who had done ANC frequently tend to have a higher score of health knowledge. They received the actual health information and advice from health practitioner while doing a pregnancy check-up. Mothers could discuss her pregnancy problems and the myths that had been spreading in their community as well [6,7]. Additionally, health professionals that had encouraged the mother to improve their health by giving health education and information through individual counseling, community or indigenous people, media campaign, or home visit showed positive result related to pregnant women's knowledge improvement and behavior change. Good EBF knowledge had given evidence about how long the EBF practice and had affected mothers to lengthen its duration[36,37,38,30,39,].

A prior study found that IBF practice was significantly a protective factor of stunting[12]. Initiative Breast Feeding had given the babies a chance to obtain the colostrum that nourishes and increase their immunity. It was also determined the successfulness of EBF practice. In contrast, Aguayo et al. (2015)[13] and this study had not shown any significant relation between IBF practice and stunting.

IFA supplementation had been evidenced by averting anemia and adverse outcome in pregnancy [40,41]. WHO had released a recommendation of IFA supplementation initiation since in adulthood and continued during pregnancy [42]. Indonesian Ministry of Health had recommended the IFA supplementation minimal 90 tablets during pregnancy to all pregnant women. A study conducted in Nepal found that pregnant women who consumed IFA more than 90 tablets had a lower risk of delivery children with stunting below 2 years compared with pregnant women who were not consumed. This result also predicted that increasing IFA consumption more than 90 tables before 6 month age of pregnancy prevent 16800 children from suffering stunting yearly [43]. In contrast, this study did not show any significant number to stunting, as the IFA double-blind randomized control trial study conducted in China. It might due to medication support and others physically assessment that covered the

supplementation effect, so it did not affect to decrease stunting percentage. The short duration of the study might be concerned as well [44].

Giving birth at the health facilities could minimize the risk of death due to delivery complication for both mother and baby. In this study, the place of delivery did not show any significant correlation to stunting. In contrast, the study conducted by Tiwari et al. (2014)[45] found that the method and place of delivery had correlated to stunting in children. It related to the mother's access to health information such as EBF, complementary feeding initiation, and baby care comprehensively for a new baby born.

The first 28 days of life were a critical period for a new baby born which almost half of the children under 5 years old (46%) died at that ages[46]. Neonatal or postpartum visitation intended to monitor the children's growth and development. A prior study found that the baby who delivered from mother that had never attended to PNC were more likely to had a higher risk of stunting at the first 24 months of life. A study in Nepal found that mothers who had visited less PNC had poor feeding practice skill which was the direct factors affected children nutritional status [47]. Postnatal care was the health workers chance to monitor the baby's and educate the mothers related to their children's growth and development. If there was any health problem with both mother and baby, they could do early action to save their life as soon as possible [48,49]. Lack of families (particularly the husband) and community supports during pregnancy might be contributed to the mother's knowledge and health behavior during pregnancy [50]. The previous study had shown that family, friends, and health practitioner support and advice influenced the mother's decision at practicing health behavior, such as EBF [51]. Moreover, people should have to practice to increase their knowledge and experience although it was not easy to do. Physicians or health professionals also should provide evidence-based information about the benefits of improving health behavior during pregnancy to all of them as well and monitoring the initiation.

3. Family hygiene and sanitation

The previous study found that open defecation behavior increased 7 percentage point of child stunting [52]. This finding was similar to the result of this study. Poor sanitation might be related to stunting through the biology and social economic factors that integrated as one in complex pathways. Biology mechanism could be explained through the infection process that leads to immune dysfunction. It would affect intestine then nutrition malabsorption occurred, such as diarrhea, worms, or environmental enteropathic dysfunction [53]. The previous study found that diarrhea continuous cumulatively increase the risk of stunting[17,54]. In contrast, this study found that children who had ever diarrhea were less likely to be stunted although it did not show any significance. In addition, hand soap washing behavior in family showed contrast with the prior study as well [26]. Then, social economic pathways related to poor sanitation could be explained as the household with lower economic level had poor sanitation that leading to stunting [53,55,27]. On the other hand, a study conducted by Sumarto dan de Silva in 2015 found

that most of the stunted children came from the household with high economic level[11]. It showed that stunting could be encountered to anyone, no matter the economic status they were.

4. Geographical factor

Decentralization has adopted in Indonesia since 1999 due to political matters and the impacts often became controversial [56,57]. It was addressed to bring the services closer to the community, thus the program became more effective and efficient and reduce inequity. In the health system context, the complexity of decentralization and health services showed positive effects related to access, utilization, and management[56,58]. However, the inequality of health system across the nation still existed, such as the number and access of health facility, insufficiently of community health center (*Puskesmas)* and health workers ratio between Jawa- Bali and other regions in Indonesia [59]. Additionally, it became worse after the decentralization system applied [57]. Lack of time and capacity of local government on program management and implementation, unclear responsibility at each level of the government, and the complexity of funding mechanism were several factors that had become an obstacle of the successful health programs implementation [60]. These matters might affect the significance of difference stunting percentage between regions in this study.

5. Limitation of the study

This study was the first cross life cycle study in Indonesia using numerous participants. Nevertheless, there were several limitations of this study that should be noted. First, there was various gestational age of the subject at enrollment, so did the age of the children. It could be introduced bias and difficult to determine what the most affected for to stunting within the life cycle is. Several mothers did not remember certainly about the number of IFA consumption during pregnancy, so for the next program, it would be better if they had IFA memo list to help them consumed it frequently and also facilitate the researcher to obtain the real consumption for reducing the bias.

E. Conclusion

The efforts to decrease stunting occurrence in Indonesia is not enough by merely improving mother's health knowledge and behavior, but these also require support from the community, particularly their family members related to healthy lifestyle and sanitation improvement through family approach. Moreover, Children stunting status is recommended to be monitored and evaluated once or twice a year. The inequality of health system development among regions needs to be decreased as well by improving local government performance.

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