

Maternal Factors and Their Effects on Stunting in Indonesia

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Abstract—Stunting is one of several health indicators that contribute to the quality of future generations of human resources. This is a very serious problem, considering the impact it can cause on the future. One of the causes of stunting is the maternal condition of the mother prior to and during pregnancy. This study aims to determine maternal factors that affect the incidence of toddler stunting in Indonesia. This study analyzes Riskesdas' 2013 data using logistic regression analysis. Maternal factors affecting stunting included mothers with an arm circumference of less than 23.5 cm, a lack of iron consumption during pregnancy, birth of the first child while under 21 years of age, low maternal education, and family economic status in quintiles 1, 2, and 3.

Keywords—maternal factors, stunting

I. INTRODUCTION

Within the last decade, nutrition in Indonesia has become a serious problem due to poor nutrition management. Riset Kesehatan Dasar (Riskesdas), in 2013, reported that 37.2 toddlers in Indonesia experienced stunting, which was slightly below the numbers in Nepal and India. Poor nutritional status (underweight) is also of concern, affecting 19.6% of toddlers. Thin nutritional status (wasting) is estimated to be at 12.1%. Alongside the thin nutritional status in Indonesia is the presence of obesity disorders, which also have an impact and are not less frightening than stunting and being underweight. This threat is experienced not only in Indonesia but also in many countries in the world.

Nutrition problems are not and cannot be considered simple. Nutritional intake that is utilized by humans can have an impact on the quality of human resources, both in the short- and long-term. Short-bodied children are strongly associated with poor educational performance, a long-lasting decline in education, and low income as an adult. Short-bodied children are also at a greater risk of growing into less educated, poorer, and less healthy adults and are more vulnerable to non-communicable diseases. Therefore, stunting is a predictor of the quality of human resources which indicates its ability to shape the nation in the future (Trihono et al., 2015).

According to the World Health Organization (WHO), many factors are responsible for stunting, including maternal health status. This is one of the driving factors in the cause of stunting in children. The condition of the mother during pregnancy is very influential on the growth of the fetus, and sleep can affect the quality of the fetus and the length of the baby later in life. Some of the most influential factors on a pregnant woman's body include food intake, calories, protein, and micronutrients. One of the measurements of stunting uses

discomfort problem information in women who are between ages 15 and 49, based on indicators of upper arm circumference (WHO, 2014). The 2013 Child Growth and Development Coordination Study also notes the relationship between KEK and weight gain during pregnancy that deviates from the standard. Likewise, another indicator is iron intake in mothers who experience anemia during pregnancy and prior to birth with low birth weight (LBW).

Women's nutrition plays a crucial role in pregnancy and the health of mothers, newborns, and children (Mason et al., 2012 in Vir, 2016). As a predictor of child health, maternal health quality is a very important problem, affecting the first day the child is born from the womb. A healthy mother will produce healthy children, which will affect the quality of life of the child. However, maternal health conditions receive less serious attention, especially regarding the effect on child nutrition. This lack of attention is marked by a variety of nutritional intervention programs that do not pay attention to the needs of women in adolescence. This research aims to determine how women with children can improve the quality of toddler health in Indonesia. What is the relationship between women's anthropometry and the incidence of stunting in infants in Indonesia? How do sociodemographic factors affect the incidence of toddler stunting in Indonesia? On the basis of these matters, the formulation of the problem in this study is as follows: a). Do maternal factors affect the incidence of stunting in infants? b). How do maternal factors and demographics affect the incidence of stunting in infants?

II. LITERATURE REVIEW

A. *Determinants of Child Growth and Development*

Mosley and Chen (1984) describe the growth of children based on a framework. The framework combines two variables, namely, biological and social variables, to integrate methods used by both social and medical scientists. The essence of this framework is the idea that all backgrounds, including both socioeconomic and cultural factors, affect the variables, operating through a set of proximate determinants and directly affecting the risk of diseases and their effects. Mosley and Chen define five categories of proximate determinants, namely, maternal factors (age, parity, and birth interval); environmental contamination (air, food, water, inanimate objects, etc.); malnutrition (calories, protein, and micronutrients); injury (accidental or intentional); and control of personal diseases (precautions and treatment) (Mosley & Chen, 2003).

According to Mosley and Chen (1984), proximate factors affect children's survival in different ways. Maternal health status affects pregnancy and infant/fetal survival. Environmental contamination affects the spread of infection in children and mothers. Lack of nutritional intake affects calorie, protein, and micronutrient status. Good nutrition in children and mothers can occur if the nutrition and diet of the mother during pregnancy are good, which ultimately affects the birth weight of the child and quantity and quality of the breast milk. The occurrence of injuries, either intentional or unintentional, can also affect growth and development. Additionally, whether patterns of disease control are realized or not, such as in childcare, is also a key factor in the survival of children (Mosley & Chen, 2003).

B. Load Framework Due to Stunting

Disease has changed in the last decade due to epidemiological changes. The theory of evolution looks at this change. This theory has two main characteristics. First, genetics have evolved so that human species can easily adapt to changes in the environment. Second, the various adaptations that occur during evolution are focused on two absolute needs. First, humans must produce individuals who are healthy and able to adapt from the fetus stage. Second, the child must have enough growth to have their own children and to protect their children (Barker, 2012). The short-term load theory framework in Fig. 1 explains the mechanism of stunting.

Uauy (2011; in (Trihono et al., 2015) explains that nutritional deficiencies in the fetus and infant, as well as the occurrence of infection and other epigenetic factors, can encourage changes in genetics and cause problems in the future. This nutritional deficiency begins in the womb, which means it starts with maternal factors. Two factors influence the growth and development of genetic diversity, namely, biological and nutritional factors and infection. These two factors can cause growth to be hampered, both in the short- and long-term.

In the short term, these factors affect brain development, muscle growth, bone development, weight, height, body composition, body metabolism, body fat, protein, hormones, and even genetics. In the long run, genetic factors, nutrition, and infection affect cognitive capacity, education, culture, immunity, work capacity, energy of the body, brain composition, energy storage, and insulin resistance. Both short- and long-term factors eventually encourage many problems if nutritional factors are not met properly and other infectious and epigenetic factors occur. This stunted growth will eventually lead to failures in school, poor education, low income, and opportunities for degenerative diseases, such as obesity, diabetes, coronary heart disease, stroke, and cancer. This will also encourage unstable economic conditions, both for individuals and for the global society (Trihono et al., 2015).

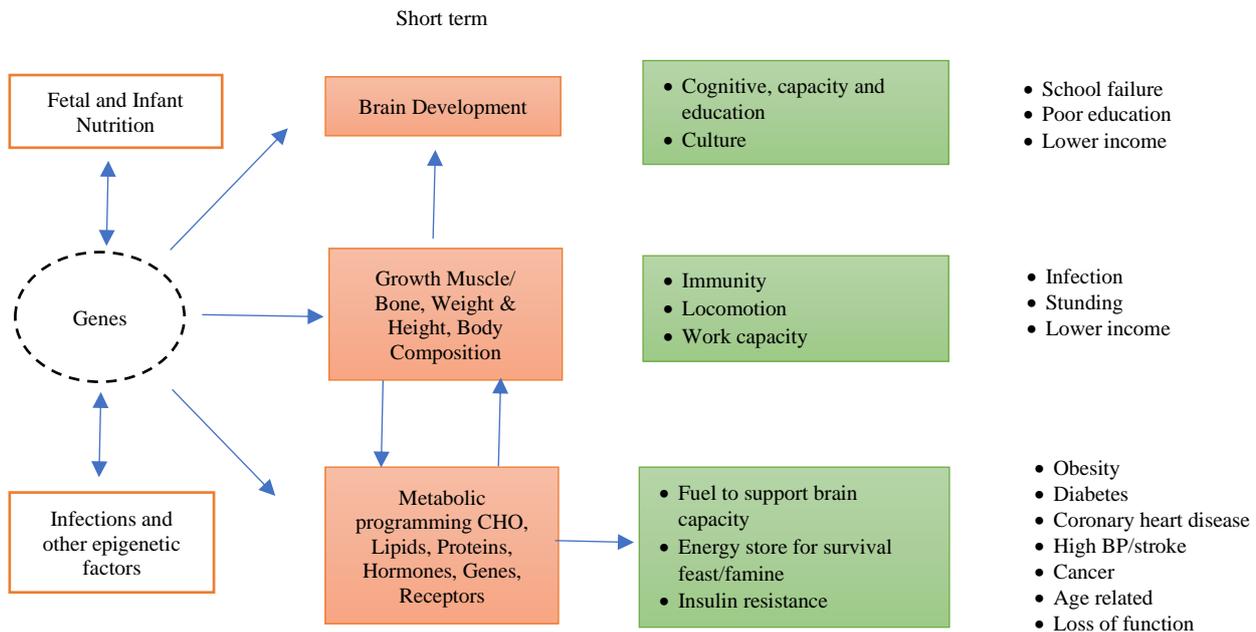


Fig. 1. Stunted Framework. Source: Uauy, 2011

C. Maternal Factors

Supariasa et al. (2000) mention that nutrition for pregnant women involves maintaining a healthy and balanced diet with a portion of two meals greater than those who are not pregnant. Malnutrition in pregnant women can affect the process of fetal growth and can cause miscarriage, stillbirth,

neonatal death, congenital defects, anemia in infants, intrapartum asphyxia (dead in the womb), and LBW. There are several methods that can be used to determine the nutritional status of pregnant women, including monitoring weight gain during pregnancy, measuring the upper arm circumference (LILA), and measuring levels of hemoglobin (Hb). The measurement of LILA is intended to determine

whether a person is suffering from chronic energy deficiency (KEK) and measuring Hb levels determines whether the mother is anemic or not. In addition, maternal age, maternal body mass index (BMI), birth order, and the number of antenatal visits affect stunting in nonlinear ways (Fenske, Burns, Hothorn, & Rehfuess, 2013).

Maternal factors significantly affect children's nutritional status, and children of educated mothers are better nourished than those who are illiterate (Mittal, Singh, & Ahluwalia, 2007). Research in Kenya by (Abuya, Onsomu, Kimani, & Moore, 2011) also mentions that children born to mothers with a basic education have a 94% lower chance of experiencing stunting compared with mothers who did not attend school. In addition, there are intergenerational consequences of early marriage on the welfare of children. Early marriage usually means giving birth early under economic conditions that are not yet established, thus affecting the development and health of children because mothers are not able to meet their nutritional needs (Efevbera, Bhabha, Farmer, & Fink, 2017).

Nkurunziza et al. (2017) conducted a study on the determinants that affect stunting children in Burundi. The results of his research illustrate that the level of maternal education, maternal knowledge about assessing children's nutritional status, and the provision of health facilities are predictors of stunted children. His research confirms that stunting in Burundi, as elsewhere, is a multi-sectoral problem. Other researchers have related stunting to health and service factors, both in mothers and toddlers (Nkurunziza, Meessen, Van geertruyden, & Korachais, 2017).

D. Toddler Nutritional Status

Toddler nutritional status is measured on the basis of age, body weight (BB) and height (TB)/body length (PB). Measurements of BB variables and TB/PB in children under 5 are presented in the form of three anthropometric indices, namely, BB/U, TB/U, and BB/TB. To assess the nutritional status of children under 5, the weight and height of each toddler are converted to standardized values using anthropometric standards for toddlers (Ministry of Health, 2010). Several terms indicating nutritional status are often used:

- poor nutrition/malnutrition (underweight),
- short (stunting), and
- thin (wasting).

Furthermore, based on the z-score value of each indicator, the nutritional status of children under 5 is determined according to the anthropometry indexes presented in Table I.

Indicators of nutritional status based on the BB/U index provide an indication of nutritional problems in general. This indicator does not provide an indication of nutritional problems that are chronic or acute because weight is positively correlated with age and height. A low BB/U indicator can be caused by stunting (chronic nutritional problem) or diarrhea or other infectious diseases (acute nutritional problems). Indicators of nutritional status based on the TB/U index provide indications of chronic nutritional problems as a result of long-standing conditions. For example, poverty, unhealthy behavior, and lack of food intake for a long time since infancy, or even the fetus stage, can result in the children being stunted (Trihono et al., 2015).

TABLE I. ANTHROPOMETRY INDEXES

| Indexes | Nutritional Status | Z-Score |
|---|--------------------|---------------------|
| Weight according to age (BB/U) Children aged 0–60 months | Malnutrition | < -3 SD |
| | Malnutrition | -3 SD until 2 SD |
| | Good nutrition | > 2 SD |
| | More nutrition | < -3 SD |
| Body length according to age (PB/U) Children aged 0–60 months | Severe stunting | < -3 SD |
| | Stunting | -3 SD until < -2 SD |
| | Normal | -2 SD until 2 SD |
| | High | >2 SD |
| Weight according to body length (BB/PB) or body weight according to height (BB/TB) Children aged 0–60 months | Severe wasting | < -3SD |
| | Wasting | -3 SD until < -2 SD |
| | Normal | -2 SD until < -2 SD |
| | Obese | > 2SD |

Indicators of nutritional status based on the index of BB/TB provide an indication of nutritional problems that are acute in nature as a result of events in short time. For example, an outbreak of a disease or a lack of food (hunger) results in children becoming thin. The BB/TB or BMI/U indicator can be used for thin and fat identification. There are also acute-chronic nutritional problems, for example, in thin and short children.

E. Demographic Social Characteristics

Some maternal sociodemographic factors can affect the nutritional status of children, both in developed and in developing countries. These factors include race/ethnicity, age, education status, and type of work. According to research by Semba et al., who conducted a study in Indonesia using data from the Nutrition Monitoring System in Indonesia from January 1999 to September 2003 in children aged 6–59 months, maternal age over 24 years and low maternal education were risk factors for low height-for-age Z-scores (HAZ) in children (Semba et al., 2008).

Researchers have also seen the role household factors play in affecting children's growth, including family income, parental education, employment status, access to healthcare, and parental health behaviors. They have found that children's health is largely related to their parents' health and economic and social status (Lee, 2008).

Caldwell (1979 in (Lee, 2008) describes the sociodemographic characteristics that are most needed to care for children so that the health and development of the children are guaranteed to be good. According to Caldwell, three sociodemographic factors are important:

- Mothers can violate customary traditions and adopt many alternative methods of care and therapy, both for themselves and for their children, and can quickly change the mindset of the community.
- Higher educated mothers are able to explain the needs of children in a modern way and are able to choose the correct facilities for their children, rather than just accepting the status quo.

- Women's education changes the family balance and has different effects on childcare patterns.

III. METHOD

This study uses the secondary cross section data of Riset Kesehatan Dasar from 2013 (Riskesdas) of the Republic of Indonesia Ministry of Health. The 2013 Riskesdas sample totaled 295,000 households and 1,027,763 individuals, with a total census block of 12,000, and the sample numbered 82,666 toddlers. However, after data cleaning by the Indonesian Ministry of Health, Research, and Development, the sample of toddlers that can be used only numbered 39,835. This is because some data are missing and not connected to maternal variables.

A. Variables

In this research, the dependent variable consists of the incidence of stunting in infants as measured by the height of children under age according to age (TB/U). The questions are grouped into two categories, namely, stunting if the measurement value is less than -3 standar deviation (SD) and -3 SD to less than -2 SD and normal if the measurement value is -2 SD to 2 SD and less than 2 SD. The independent variables consist of WUS with LILA <23.5 cm, iron consumption, age at first pregnancy, maternal education, and family economic status. The variables are presented in Table II.

TABLE II. VARIABLES

| Variable | Description |
|--|---|
| Stunting in toddlers (STUNTING) | 1 = stunting (< -3 SD and -3 SD until < -2 SD) 0 = normal (≥ -2 SD) |
| Women with upper arm circumference < 23.5 cm (ARM) | 1 = <23.5 cm (KEK) 0 = >23.5 cm (non-KEK) |
| Anemia in pregnant women (IRON) | 1 = not consuming iron 0 = consuming iron |
| Age of first pregnancy (AGE) | Young = 1 (1 = <21 years, 0 = others) Not young = 2 (1 = 21-34 years, 0 = others) Old = 3 (Reference) |
| Maternal education (EDUC) | High = 1 (1 = D1-S3, 0 = others) Intermediate = 2 (1 = SMA, 0 = others) Low = 3 (Reference) |
| Wealth quintile (ECO) | 1 = Low if quintile 1, 2, 3 0 = High if quintile 4,5 |

B. Analysis

characteristics of stunted toddlers in Indonesia. From the Table, we can see the characteristics of stunting in households in Indonesia. The inference analysis method uses logistic regression. In this study, the method of analysis was used to determine maternal trends in the incidence of stunting in Indonesia.

Binomial logistic regression analysis method is an analysis method that describes the relationship between a response variable that is qualitative/categorical with one or several explanatory variables. This study uses this analysis method because the explanatory variables and response variables are categorical, so they are suitable to be used to see the effect of the explanatory variables on the response variable. The value of the response variable (Y) can be divided into two categories: "success" or "fail," with the notation Y = 1 (success) and Y = 0 (fail), following the Bernoulli distribution for each observation.

In this study, "success" indicates toddler stunting, whereas "failure" indicates a normal toddler. The assumption of the relationship of the response variable (Y) and the explanatory

variable (X) is expressed as E (Y | X), which has a probability between 0 and 1, or

$$0 \leq E (Y | X) \leq 1 \tag{1}$$

Response variables in the binary logistic regression have values of 0 and 1, which are random variables that follow the distribution of Bernoulli (Agresti, 1990). Hosmer and Lemeshow (1989) provide a general form of logistic regression opportunity models with factors with formulations:

$$\pi(x) = \frac{\exp(\beta_0 + \beta_1 x_1 + \beta_2 x_2 + \dots + \beta_p x_p)}{1 + \exp(\beta_0 + \beta_1 x_1 + \beta_2 x_2 + \dots + \beta_p x_p)} \tag{2}$$

Where:

where $\pi(x)$ is the chance of "success" (Y = 1), β_j is the parameter value, $j = 0, 1, \dots, p$.

Thus, in (1), the hope values and Y variants are (x) and $\pi(x) [1 - \pi(x)]$, respectively. The model is nonlinear and is difficult to understand, so it is necessary to do a logit transformation to make it easier to see the relationship between the response variables and explanatory variables using

$$\text{Logit } \pi(x) = \ln \left[\frac{\pi(x)}{1-\pi(x)} \right] \quad (3)$$

C. Parameter Estimation

In the logistic regression model, the expectation value of the response variable is not linear to the β parameter, so the β estimator is obtained through the maximum likelihood method. To get the β parameter, the Stata Version 14.0 program package is used. Interpretation of the coefficients in the logistic regression function is carried out in the form of an odds ratio. An odds ratio is a measure to determine the risk of a tendency to experience a particular event between one category and another in a variable. An odds ratio is denoted

$$\ln \left(\frac{p}{p-1} \right) = \alpha + \beta_1 \text{Arm} + \beta_2 \text{Iron} + \beta_3 \text{Age1} + \beta_4 \text{Age2} + \beta_5 \text{Educ_Secondary} + \beta_6 \text{Educ_Primary} + \beta_7 \text{Wealth} + e \quad (4)$$

IV. RESULTS AND ANALYSIS

The discussion of the results and analysis will be divided into descriptive analysis and inferential analysis, each of which explains the impact of maternal factors on the incidence of stunting in Indonesia.

A. Descriptive Analysis

This study analyzed infants under 5 years old (toddlers), who had stunting and did not have stunting (normal). The formation of these categories is based on the calculation of height per age (TB/U) of the toddlers carried out by the Ministry of Health of the Republic of Indonesia (Ministry of Health RI). The height of a toddler is categorized as stunted if it is included in the calculation of the short and very short categories, and the toddler is not stunted if the height is categorized as not short or normal when entered in the calculation of normal and high categories according to the HAZ standard in the anthropometric index.

Since 2005, the WHO has used stunting as an indicator of children's nutritional status. Other indicators used are thin nutritional status (wasting) and poor nutritional status (underweight). Stunting indicators for children are used by looking at the child's body length according to their age. Stunting is the most appropriate measure for the nutritional status of children because stunting is not only a very short issue but an issue that can give an indication of chronic nutritional problems that last a long time, ever since women conceived.

The results of the 2013 Riskesdas data state that stunting cases in Indonesia were increasing year by year. Stunting cases in Indonesia are currently still lower than in 2000, which recorded that 42.2% of Indonesian toddlers were experiencing stunting. As shown in Fig. 2, in 2007, the status of short toddlers in Indonesia was 36.8%, with the very short composition higher than the short status. In 2010, the number of stunted toddlers in Indonesia amounted to 35.6% and very short toddlers are still dominant. In 2013, the number of stunted toddlers in Indonesia increased to 37.2% of the total population under 5 in Indonesia.

When compared with several countries in the Southeast Asian region, Indonesia is classified as a country with a

by θ and is defined as the ratio of odds of $x = 1$ to $x = 0$. In other words, the risk of the tendency of the effect of observation $x = 1$ is n times the risk compared with the observation of $x = 0$. In this study, the odds ratio is used for knowing the tendency of the influence of explanatory variables on the response variable. Estimating odds ratio for each increase in one unit j x assuming the other x remains, namely $\theta_j = \exp(\beta_j)$, then $\ln \theta_j = \beta_j$.

D. Model in Research Analysis

The regression model for the influence of maternal factors on the incidence of stunting of children under 5 is

stunting status above the regional average of 33.8%, and cases of stunting in Indonesia are far above the incidence in Sri Lanka and Thailand. The amount is almost the same as in Bangladesh, Nepal, and India. Indonesia is the country with the fifth most stunting cases in the world.

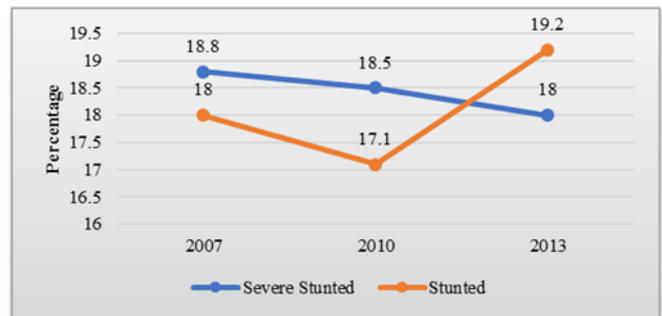


Fig. 2. Percentage of Stunted Toddlers in Indonesia, 2013. Source: Riskesdas, 2013

This situation also has not improved, and the trend that has occurred shows an increase in the prevalence of stunting in various provinces in Indonesia. Another problem is that the disparity in stunting cases is very wide and spread throughout Indonesia. Stunting cases in 2013, the lowest report from Riskesdas, was around 26.3% in the Riau Islands, and the highest was in East Nusa Tenggara, which was 51.7%. Out of 33 provinces in Indonesia, 12 provinces are in the heavy category of stunting cases, namely, the number of stunting toddlers is 30–39%, and the other 13 provinces are in the very heavy category, which amounts to greater than or equal to 40%.

The Riskesdas 2013 data recorded that the distribution of stunting toddlers in Indonesia is very wide. Of the 33 provinces in Indonesia, the number of children under 5 experiencing stunting in 20 provinces was above the percentage of national stunting under 5, with the highest to lowest prevalence, namely, (1) East Nusa Tenggara, (2) West Sulawesi, (3) West Nusa Tenggara, (4) West Papua, (5) South Kalimantan, (6) Lampung, (7) Southeast Sulawesi, (8) North Sumatra, (9) Aceh, (10) Central Kalimantan, (11) North Maluku, (12) Central Sulawesi, (13) South Sulawesi, (14) Maluku, (15) Papua, (16) Bengkulu, (17) West Sumatra, (18) Gorontalo, (19) West Kalimantan, and (20) Jambi.

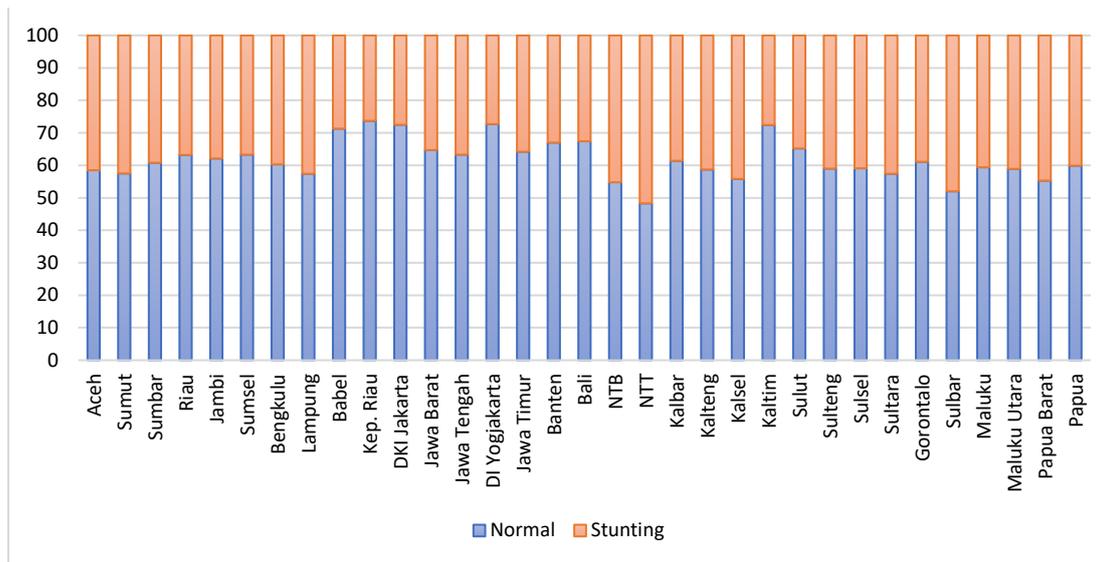


Fig. 3. Percentage of Stunted and Not Stunted Toddlers in Indonesia, 2013. Source: Riskesdas, 2013

TABLE III. STUNTING CHARACTERISTIC DEMOGRAPHIC

| Characteristic | Nutritional status TB/U | | |
|--|-------------------------|----------|--------|
| | Severe stunting | Stunting | Normal |
| | (%) | (%) | (%) |
| Age Group (Months) | | | |
| 0-5 | 14.1 | 10.8 | 75.1 |
| 6-11 | 16.9 | 11.6 | 71.5 |
| 12-23 | 19.6 | 19 | 61.4 |
| 24-35 | 20.6 | 21.4 | 58 |
| 36-47 | 18.2 | 21.5 | 60.4 |
| 48-59 | 16.2 | 22 | 61.7 |
| Sex | | | |
| Male | 18.8 | 19.3 | 61.9 |
| Female | 17.1 | 19.1 | 63.7 |
| Household Head Educational Background | | | |
| Not Educated | 21.1 | 20.2 | 58.7 |
| Did not graduate from elementary school | 20.4 | 20.8 | 58.8 |
| Elementary School | 20.4 | 21.7 | 57.9 |
| Junior High School | 18.3 | 19.7 | 62 |
| High School | 15.3 | 17 | 67.7 |
| University | 13.3 | 14 | 72.6 |
| Occupation | | | |
| Unemployed | 16.9 | 17.3 | 65.7 |
| Employee | 14 | 15.6 | 70.4 |
| Entrepreneur | 17.1 | 18.4 | 64.4 |
| Farmers/Fishermen/Laborers | 20.6 | 21.7 | 57.7 |
| Other | 17.7 | 19.4 | 62.9 |
| Spatial | | | |
| Urban | 15.2 | 17.3 | 67.5 |
| Rural | 20.9 | 21.2 | 57.9 |
| Wealth Quintile | | | |
| Lower | 25.2 | 23.2 | 51.6 |
| Lower middle | 20.2 | 22.2 | 57.6 |
| Middle | 17.9 | 20.6 | 61.5 |
| Upper Middle | 15.1 | 17.2 | 67.7 |
| Upper | 14.4 | 14.6 | 71 |

East Nusa Tenggara is the province with the highest percentage of stunting toddlers in Indonesia, amounting to 51.7%, which means that five out of ten toddlers in NTT are in the status of stunting nutrition. In addition, West Sulawesi and West Nusa Tenggara are also the provinces with the highest prevalence of stunting. The lowest percentage of stunting toddlers in the province of the Riau Islands was 26.3%. Fig. 3 shows the percentage of stunting and non-stunting toddlers in Indonesia by province.

The stunting problem, according to the WHO (2010), is categorized as heavy if the prevalence of stunting under the age of 5 is 30–39% and serious if the prevalence of shortness is greater than 40%. As many as 13 provinces in Indonesia are categorized as heavy, namely, West Sumatra, Riau, Jambi, South Sumatra, Bengkulu, West Java, Central Java, East Java, Banten, Bali, West Kalimantan, North Sulawesi, and Gorontalo. In the serious category, there are 15 provinces, namely, Papua, Maluku, South Sulawesi, North Maluku, Central Sulawesi, Central Kalimantan, Aceh, North Sumatra, Southeast Sulawesi, Lampung, South Kalimantan, West Papua, West Nusa Tenggara, West Sulawesi, and East Nusa Tenggara.

Of the 15 provinces in the serious category, most are in the eastern region. When compared with the “non-public health problem” limit, according to the WHO, for the problem of stunting, which is 20%, all provinces are still in a state of public health problem. According to age groups, it can be seen in Table III that the 24- to 35-month-old age group has the greatest stunting status in Indonesia. The least is in the age group of 0–5 months. In addition, male toddlers are more exposed to stunting than female toddlers, in accordance with Indonesia's infant mortality rate, which is higher for male toddlers compared with girls. The percentage of severe stunting is greater than stunting in the age group of 0–23 months. The stunting toddler group is dominated by the age group of 24–59 months. Table III shows the characteristics of stunting toddlers in Indonesia.

Toddler nutritional status is also an outcome of the educational status of the mother. Mothers with low school education (did not graduate from school/did not graduate from elementary school/graduated from elementary school/graduated from junior high school) had the most likely households of having toddlers exposed to stunting at an average of approximately 40.65%. Households with secondary maternal education (SMA/SMK equivalent) averaged a toddler stunting rate of 32.2%, and households with high KRT education (D1 and above) averaged 27.3%. In households with high household education, the stunting rate is still high at 27.3%.

For wealth quintiles, many stunting toddlers in Indonesia also come from wealth quintiles 4 and 5 (upper and upper middle). Approximately 32.3% of children from quintile 4

(upper middle) experienced stunting, and 29% of children from quintile 5 (upper) also experienced stunting. For quintile 1 (lowest), 48.4% of children were stunted, as were 42% in quintile 2 and 38.5% in quintile 3. It is still a large question as to why there are still toddlers who are stunted in families who have financial adequacy. This shows that this very complex child nutritional status problem of stunting is not only a nutritional problem that is characteristic of the poor but also a common problem regarding maternal nutrition.

As for the type of work, farmers, laborers, and fishermen are a group that is prone to experience stunting. This is in line with the poverty status of the Indonesian population, which is dominated by workers in the agricultural sector. In addition, residents who live in rural areas are at a higher risk than those who are in urban areas.

B. Inferential Analysis

consumption, age at first pregnancy, maternal education, and family economic status on the risk of toddler stunting by estimating parameters using an odds ratio. The estimation of risk or tendency of stunting according to certain characteristics can be seen from the value of the odds ratio in the model estimation results. An odds score that is close to one indicates the same tendency between certain categories, whereas less than one indicates a smaller risk for a toddler to be stunted, and greater than one indicates a greater risk for a toddler to be stunted.

Interpretation of the odds estimation explains the risk/tendency of toddlers, with a characteristic value of one (according to the operational definition of the variable) to experience stunting. Characteristics of mothers with an upper arm circumference of less than 23.5 cm are worth one for chronic energy deficiency (KEK). Iron consumption by mothers during pregnancy is also worth one for those who do not consume iron. The age of first pregnancy, which is a reference, is the non-reproductive age group (above 35 years old). For the mother's education level, the reference for interpretation is mothers with low education (junior high school). The economic status of the family is worth one if it is included in the low category (wealth quintile 1, 2, or 3). The estimation results are shown in Table IV.

On the basis of the results of the study of the dependent variables, maternal factors (upper arm circumference, iron consumption, age at first pregnancy, maternal education, and family economic status) affect the risk of stunting events in Indonesian toddlers, as seen from the p-value of each variable estimate. The value of statistics of G (–2 Log Likelihood) are –26194.743, which means that the model is “fit,” or overall good, and can be used in subsequent analyses. The probability variables of the independent variables included in the model to see trends in the incidence of stunting in infants in Indonesia are as follows:

$$\ln\left(\frac{p}{p-1}\right) = -0.5180084 + 0.1739806Arm - 0.0694744Iron - 0.0516808Age1 + 0.0273278Age2 + 0.1148321Educ_Secondary + 0.2937498Educ_Primary - 0.3102482Wealth \quad (5)$$

TABLE IV. ODDS RATIO OF STUNTED TODDLERS IN INDONESIA

| Stunting | Coefficient | Standard Error | z | P>z | [95% Confidence | Interval] |
|----------------|-------------|----------------|--------|-------|-----------------|------------|
| Arm | 0.1739806 | 0.0257458 | 6.76 | 0 | 0.1235198 | 0.2244413 |
| Iron | -0.0694744 | 0.0314593 | -2.21 | 0.027 | -0.1311334 | -0.0078153 |
| AGE 21-35 | -0.0516808 | 0.0223353 | -2.31 | 0.021 | -0.0954572 | -0.0079045 |
| AGE > 35 | 0.0273278 | 0.1126066 | 0.24 | 0.808 | -0.1933772 | 0.2480327 |
| Educ_Secondary | 0.1148321 | 0.0408004 | 2.81 | 0.005 | 0.0348648 | 0.1947994 |
| Educ_Primary | 0.2937498 | 0.0411832 | 7.13 | 0 | 0.2130321 | 0.3744674 |
| Wealth | -0.3102482 | 0.0234644 | -13.22 | 0 | -0.3562375 | -0.2642588 |
| _cons | -0.5180084 | 0.0528027 | -9.81 | 0 | -0.6214997 | -0.414517 |

^a Source: Riskesdas, 2013.

A binary logistic regression test based on stunting toddler samples obtained a constant value with a negative sign (-0.5180084), meaning that the tendency of stunting events is 0.595 times higher than the tendency for normal toddlers if all the independent variables are arm circumference not indicating chronic energy deficiency, consuming iron, the age of first pregnancy is under 21 years, low maternal education, and high family economic status. The test results for each independent variable show that not all variables have a statistically significant effect on the incidence of toddlers stunting in Indonesia. Age variables for the age group of 35 years and above were not significant, but the direction of the relationship shows a positive number of stunting conditions when compared with the age group of mothers who gave birth under the age of 21 years.

A slope for the variable of upper arm circumference of 0.173 explained the tendency of women with an upper arm circumference of less than 23.5 cm to have a risk of stunting 1.19 times compared with mothers with arm circumference greater than 23.5 cm. In other words, women who have an upper arm circumference of less than 23.5 cm have a greater risk of having a stunting child. This indicates that mothers with chronic energy deficiency encourage the occurrence of stunting in infants. Maternal nutritional status measured through the upper arm circumference provides an initial description that maternal nutrition prior to pregnancy can be a basic problem in the occurrence of stunting.

A slope for the iron consumption variable of -0.0694744 means the tendency of mothers who do not consume iron when pregnant have a risk of stunting 0.93 times compared with mothers who consumed iron when pregnant. In other words, women who do not consume iron during pregnancy have a greater risk of stunting. This is consistent with the results of the 2012 IDHS that of the 80% of pregnant women who were given iron during their pregnancy, only 15% consumed it. The slope of the mother's age variable when pregnant for the first time was -0.0516808, which means that the non-young age group (21-35 years) had a smaller chance of having a stunting child compared with those who experienced their first pregnancy at a younger age (under 21 years). In other words, the tendency of mothers in the non-young age group (21-35 years) to be at risk of stunting toddlers is 0.95 times compared with younger age groups.

The slope of the maternal education variable was 0.1148321 for secondary education and 0.2937498 for low education, which means that secondary and low education

resulted in a higher chance of the incidence of stunting of children under 5 compared with high maternal education. In other words, low and middle school education results in a greater risk of having stunted children. This is in line with Waters (2004 in Lee, 2008), who found that children from mothers with higher levels of education or older mothers were less likely to experience stunting.

The slope of the family economic status variable was -0.3102482, which means that high economic status reduces the chances of stunting. The tendency when the family's economic status is low (quintiles 1, 2, and 3) is 0.733 times compared with families with high economic status (quintiles 4 and 5). This illustrates that families with low economic status increase the chances of stunting in children under five due to the lack of ability to provide adequate nutrition to the family. In line with the study of Waters et al. (2014 in Lee, 2008) found that the family's economic status is a protective effect on malnutrition which means families with larger economies are more likely to be able to buy better quality food and healthcare. It will encourage reduces the chances of stunting. As a result, they tend to have healthier and more well-nourished children.

V. DISCUSSION

Indonesia, as a country with a patriarchal culture, still places women in the role of a source of childcare, including child health issues. The patriarchal culture that is still mainstream in Indonesia still places women in charge of domestic decisions. This encourages women to take care of domestic needs but to pay little attention to their own health. This past decade, children's nutritional status has become a serious concern in the world and is associated with women as mothers.

Research on child stunting focuses on non-nutritional factors in the mother, such as education, income, and employment of women who become mothers. In the past decade, a number of studies have provided evidence of the role of non-nutritional factors that impact women's nutrition, fertility, maintenance practices, and children's nutritional status. This proves that the problem of stunting is very complex and indicates problems that are not only instantaneous. Stunting involves maternal problems since reproductive growth in cycle of women period. In the long term, through the quality of health of women, stunting affects quality of human resources. Various studies in South Asia prove that women are the main key to nutritional status. The

continuation of a healthy generation depends on the condition of the woman since the initial cycle of her life (Vir, 2016).

The first thousand days of the child determine the child's health in the future and can be understood to be key in seeing the problem of stunting in children under 5 in Indonesia. If it is demanded that the concept of the first thousand days of the child begins when the child is in the mother's womb, this means that the contribution of the mother as the first place of child development is the key to the problem of stunting. Mothers with poor nutritional conditions contribute significantly to the children's nutrition, which, in turn, has implications for the children's overall health. This is evidenced by the findings in this study that women with an arm circumference of less than 23.5 cm have the potential to give birth to a stunted child compared with women with an arm circumference of more than 23.5 cm. This arm circumference proves the nutritional intake received by women since the time of their physical growth. Chronic energy deficiency, characterized by an arm circumference of less than 23.5 cm, can be traced as a lack of nutritional intake received by women. This lack of nutrient intake can be caused by low female income, low levels of education, and various other economic factors that ultimately lead to a lack of awareness of nutrition.

In addition, the tendency of women to marry at a young age (early marriage) is also a predictor of maternal factors that encourage the occurrence of stunting. This is in line with various studies that indicate the indirect relationship between marriage at a young age and earlier births. Economic factors often encourage women to enter marriage more quickly. When women enter marriage life in early age, women will have low years of schooling and become not productive in labor market. The low years of schooling encourage women to give birth to their children, the cycle of poverty will continue (Efevbera et al., 2017).

VI. CONCLUSION

On the basis of the research objectives to determine maternal factors and their relationship to the incidence of stunting in children under 5 in Indonesia, maternal factors can have a significant influence on the incidence of stunting of infants in Indonesia. In addition, maternal factors encourage the incidence of stunting of children under 5 in Indonesia for mothers with an arm circumference of less than 23.5 cm, those not consuming iron during pregnancy, giving birth for the first time under 21 years old, low maternal education, and family economic status in quintiles 1, 2, and 3.

Ensuring a woman enters a pregnancy with a high and sufficient weight and free from anemia is very important.

Encouraging women to be healthy and not lack chronic energy means helping future generations be free from nutritional problems. Combining nutrition-specific interventions with steps for women's empowerment is very important. Increased food intake and women's health services, prevention of early marriage and conception, completion of secondary education, increased purchasing power, reduction of tedious work, and elimination of domestic violence deserve special attention.

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