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Chronic Energy Deficiency In Pregnancy is An Influential Factor In The Occurrence Of Stunting In Toddlers

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ABSTRACT

Stunting refers to one of the health issues that often occurs in toddlers. A failure in growth brought on by chronic malnutrition and health issues during growth is known as stunting. Stunting can be caused by various factors. There have been many studies that discuss risk factors for stunting, but there are still differences in research results from various risk factors for stunting including maternal factors. The objective of this research is to analyze the influence of the maternal factors on the stunting's prevalence in toddlers in the working site of Pakis Aji Health Center, Regency of Jepara. This is an analytic observational study using a case-control approach. The case group consists of stunted toddlers in the ages 24-59 months, while the control group consists of non-stunting toddlers between the age of 24 months and 59 months. The sampling method employed successive sampling. The research data included both primary and secondary data. Chi-square as well as logistic regression tests were used to analyze the topic. Result in this study show a significant effect of the history of Chronic Energy Deficiency (CED) in mother's pregnancy (*p-value* = 0.009; OR = 3.619) and employed mothers (*p-value* = 0.026; OR = 3.143) with the occurance of stunting in children aged 24-59 months. While maternal age during pregnancy, mother's education level, history of hypertension in mother's pregnancy, and history of anemia in mother's pregnancy had not affect the occurance of stunting in toddlers. The results of multivariate analysis showed that a history of CED during pregnancy was the most influential factor in the occurrence of stunting. In conclusion, CED during pregnancy is the most influential maternal's factors in the occurrence of stunting in toddlers.

Keywords: CED, employed mothers, maternal factors, stunting, toddlers aged 24-59 months

One of the main health problems that is often experienced in children at their golden age is stunting. Stunting, which is one of the problems of nutritional status in children, can occur because growth failure due to health problems during growth or chronic malnutrition.[1] The existence of stunting indicates malnutrition that happened for a long time (chronic) and these conditions can occur while the baby is still in its mother's womb, especially during the first 1000 days of life. The stunting condition will usually only be seen after the child is two years old.[2] When the height-for-age z-score (HAZ) is lower than -2 standard deviations (SD), it indicates stunting.[3]

According to data gathered by the World Health Organization (WHO), 22% of children under five worldwide were stunting in 2018, while on Indonesia, 21,6% toddlers were have stunting, per the outcomes of the Indonesian Nutritional Status Study (SSGI) survey conducted in 2022.[4] It is clear that the stunting's rate in Indonesia remains on high level, as it is above the WHO guideline of 20%.[5]

In Jepara Regency, prevalence of stunting based on the SSGI survey in 2022 was 18.2%, this remains higher than the government's 2024 stunting-free program aim, 14%.[5,6] In line with the data from the Jepara Regency Health Office in 2022, the area that contributed the most stunting toddlers was Pakis Aji District where the prevalence reached 18.9% with a total of 580 stunting toddlers out of 3087 recorded toddlers.[7]

Stunting can be caused by various factors, stunting can result from socioeconomic factors, environmental factors, history of infection, and

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LBW. Furthermore, maternal factors, such as inadequate nutrition intake during preconception, pregnancy, and lactation, can also result in stunting.[8]

The impact that can occur in children who suffer from stunting is that they cannot reach their maximum growth potential.[9] In addition, stunting can result in decreased motor, cognitive, and verbal development, an increased chance of illness and death, and a higher chance of developing degenerative diseases later in life. This is due to the fact that individuals with stunting are more likely to be obese, and individuals with short stature have low ideal body weights, meaning that even a small amount of weight gain can cause an individual's Body Mass Index (BMI) to climb above normal levels.[2]

Prevention of stunting requires holistic or comprehensive efforts. Based on Presidential Regulation of Republic Indonesia Number 72 of 2021, pregnant women are one of the target groups in the program to accelerate stunting reduction.[10] Planning efforts made on mothers during pregnancy include improving maternal nutrition during pregnancy, namely the need to get an adequate diet, so that mothers do not experience Chronic Energy Deficiency.[6]

In previous studies, it was found that maternal age and mother's education level had a significant relationship with the incidence of stunting.[11,12] Research conducted at the Sopaah Health Center, Pamekasan Regency in 2022 stated that there was a significant relationship between hypertension in pregnancy (HDK) and the incidence of stunting.[13] There was also an association between the history of SEZ and anemia of pregnant women with the incidence of stunting.[14]

Research on risk factors for stunting is still underway, based on the description above, the authors conducted research activities on the effect of maternal factors on the occurrence of stunting in toddlers in the work area oof Pakis Aji Primary Health Center, Jepara Regency. The research's objective is to analyze the maternal factors impact on the occurrence of stunting in toddlers in the Pakis Aji Health Center working site, Jepara Regency.

METHODS

Using a retrospective approach, this study uses a case control research approach and is an analytical observational study. This research was conducted in March 2024 in the Pakis Aji Primary Health Center's working area. The sample in this study were 80 mothers with toddlers aged 24-59 months consisting of 40 samples in the case group and 40 samples in the control group using consecutive sampling technique. Cases were children under five who suffered from stunting using the height-for-age index (HAZ <-2 SD), while controls were children under five who were not stunting (HAZ ≥-2 SD). Inclusion criteria included toddlers with HAZ < -2 SD in the case group and toddlers with HAZ index ≥ -2.0 SD in the control group, residing / domiciled in the Pakis Aji Health Center's work area, and having a Maternal and Child Health (KIA) book. Besides that, the criteria of exclusion in this study are, toddlers who have congenital abnormalities: chromosomal abnormalities (Down syndrome), congenital heart disease, congenital hypothyroidsme, and facio-oral abnormalities (labioschisis, palatochisis, labiopalatochisis), toddlers who are often sick (in 1 month at least 1 time) such as acute respiratory infections, urinary tract infections, diarrhea or with a history of tuberculosis (TB), and toddlers who have backbone abnormalities (scoliosis, lordosis, kyphosis).

The case of stunting serves as the variable of dependent, while maternal factors consisting of maternal age, mother's occupation, mother's education level, history of hypertension in pregnancy, history of Chronic Energy Deficiency (CED) in the pregnancy's period, and history of anemia in mother's pregnancy serves as the independent variables.. The type of data in this study comes from primary and secondary data. Interviewing with questionnaires was used to obtain primary data and secondary data came from respondents' Maternal and Child Health (KIA) books and Pakis Aji Primary Health Center nutrition reports. Nutritional status (stunting/non stunting) of toddlers refers to the MCH book data from the posyandu measurement period March 2024. The Chi-Square test was employed for bivariate analysis in this study, as well as logistic regression for multivariate analysis.

RESULTS

Characteristics of Respondents

a) Toddler's Characteristics

Table 1. Toddler's characteristics in the Pakis Aji Primary Health Center's work area

Characteristics of Toddlers	Stunting status		Total
	Stunting	*Non Stunting*	
	n (%)	n (%)	n (%)
Age Group			
24-35 months old	17 (42,5)	17 (42,5)	34 (42,5)
36-47 months old	12 (30)	13 (32,5)	25 (31,3)
48-59 months old	11 (27,5)	10 (25)	21 (26,3)
Gender			
Male	17 (42,5)	18 (45)	35 (43,8)
Female	23 (57,5)	22 (55)	45 (56,3)

Table 1 shows that among the case and control groups, 42.5% of toddlers were in the age range of 24-35 months. Based on gender characteristics, most of toddlers in the case and control groups were female, with 57.5% and 55% respectively.

b) Characteristics of Mothers

Table 2. Characteristics of Mother's Toddlers

Characteristic of Mothers	Status Stunting		Total
	Stunting	Non Stunting	
	n (%)	n (%)	n (%)
Maternal age			
< 20 years and > 35 years	12 (30)	8 (20)	20 (25)
20-35 years	28 (70)	32 (80)	60 (75)
Mother's Education Level			
<Senior High School	18 (45)	17 (42,5)	35 (43,8)
≥Senior High School	22 (55)	23 (57,5)	45 (56,3)
Mother's occupation			
Employed	16 (40)	7 (17,5)	23 (28,7)
Unemployed	24 (60)	33 (82,5)	57 (71,3)
Hypertension during pregnancy	7 (17,5)	4 (10)	11 (13,8)
Hypertension	33 (82,5)	36 (90)	69 (86,3)
Normal			
CED during pregnancy	19 (47,5)	8 (20)	27 (33,8)
CED	21 (52,5)	32 (80)	53 (66,3)
Normal			
Anemia during pregnancy	22 (55)	15 (37,5)	37 (46,3)
Anemia	18 (45)	25 (62,5)	43 (53,8)
Normal			

In table 2, it can be concluded that most of the mothers were in the 20-35 years age category during pregnancy (75%), highly educated (56.3%), unemployed (71.3%), had no history of hypertension during pregnancy (86.3%), had no history of CED in pregnancy (66.3%), and had no history of anemia during pregnancy (53.8%).

Bivariate and Multivariate Analysis

Table 3. Results of Bivariate and Multivariate Analysis of Maternal Factors on the Occurence of Stunting

Characteristics of Mothers	Stunting status		Bivariate Analysis		Multivariate Analysis		
	Stunting	Non Stunting	*p-value*	OR (95% CI)	B	*p-value*	OR (95% CI)
	n (%)	n (%)					
Maternal age							
< 20 years and > 35 years	12 (30%)	8 (20%)	0,439	1,714 (0,613-4,794)	-	-	-
20-35 years	28 (70%)	32 (80%)					
Mother's Education Level							
<Senior High School	18 (45%)	17 (42,5%)	1,000	1,107 (0,457-2,679)	-	-	-
≥Senior High School	22 (55%)	23 (57,5%)					
Mother's occupation							
Employed	16 (40%)	7 (17,5%)	**0,048***	3,143 (1,120-8,822)	0,926	0,091	2,524 (0,861-7,398)
Unemployed	24 (60%)	33 (82,5%)					
Hypertension during pregnancy	7 (17,5%)	4 (10%)	0,516	1,909 (0,512-7,119)	-	-	-
Hypertension	33 (82,5%)	36 (90%)					
Normal							
CED during pregnancy							
CED	19 (47,5%)	8 (20%)	**0,018***	3,619 (1,341-9,765)	1,120	**0,032***	3,064 (1,103-8,512)
Normal	21 (52,5%)	32 (80%)					
Anemia during pregnancy							
Anemia	22 (55%)	15 (37,5%)	0,178	2,037 (0,834-4,976)	-	-	-
Normal	18 (45%)	25 (62,5%)					

Based on the table of bivariate analysis results between maternal factor variables and the occurence of stunting above, it is known that mother's occupation status and history of CED in mother's pregnancy affect the occurence of stunting in toddlers ($p<0.05$). Employee mothers are at risk of 3.143 times greater having stunting toddlers compared to unemployed mothers ($p=0.048$; OR = 3.143; CI: 1.120-8.822). History of CED during mother's pregnancy had a 3.619 times greater risk of having stunting toddlers compared to mothers without a history of CED ($p=0.018$; OR= 3.619; CI: 1.341-9.765). Meanwhile, the factors of maternal age during pregnancy, mother's education, history of hypertension and anemia in mother's pregnancy showed that the four factors did not effect on the occurence of stunting in toddlers ($p>0.05$).

The logistic regression analysis revealed that the case of stunting in children is most strongly impacted by CED in mother's pregnant history ($p=0.032$, OR=3.064, CI=1.103-8.512) rather than the variable of mother's occupation ($p=0.091$, OR=2.524, CI=0.861-7.398). The variable history of CED in the pregnancy period has a statistically significant 0.032 p value and 3.064 OR. This indicates that mothers with CED's history in the pregnancy period have a 3.064 times higher chance of influencing the occurrence of stunting among toddlers.

DISCUSSION

Maternal Age

From the statistical test revealed that maternal age did not have any effect on the occurrence of stunting among toddlers in the Pakis Aji Health Center's work area between the age of 24 months to 59 months. The findings of this research match up with studies carried out in the Sopaah District, Pemekasan Regency in 2021 which states that the occurrence of stunting is not influenced by maternal age.[15] However, additional research conducted in Pujon District in 2018 have shown different result, where this study found a significant relationship between the age of mother during pregnancy and the occurrence of stunting among toddlers in the Pujon Health Center's work area, Malang Regency (OR=3,86).[16]

Maternal physiological and psychological factors affect fetal development as well as growth in their first 1000 days of life. The physiological and psychological maturity of the mother is determined by the mother's age during the period of pregnancy. Pregnancy and childbirth that occur before the age of 20 will have a high risk of preterm birth and low birth weight (LBW), leading to stunting in children.[15] In addition, pregnant women who are <20 years old can be at risk of maternal and infant mortality because they are considered physically unprepared due to their physiological functions and the development of reproductive organs that are not yet optimal. In addition, psychologically, the emotions and psychology of young mothers are not mature enough, so the mother does not have the readiness to face pregnancy and care for the child.[17] Meanwhile, if mothers experience pregnancy at the age of >35 years or in old age, they also have a risk of giving birth to stunting toddlers because at this time women are more susceptible to several diseases that can interfere with the health of mothers and babies during pregnancy to childbirth.[15] Pregnant women over the age of 35 tend to be unenthusiastic in taking care of their pregnancies, besides that at an older age there is also a decrease in the absorption of nutrients which will result in unbalanced food intake and malabsorption which results in nutritional deficiencies in the baby.[18]

In this study, the occurrence of stunting was not influenced by maternal age during pregnancy. This can occur because the majority of mother's toddlers, both stunting and not stunting, are 20-35 years old (non-risk age category) during their pregnancy. Furthermore, women over 35 are typically well-established and possess adequate health information, which helps them feel more prepared for parenthood.

Mother's Education Level

According to this research, it was found that the degree of mother education had no effect on the occurrence of stunting in toddlers in the Pakis Aji Health Center's work area aged 24-59 months. This study's findings are in accordance with research done in Kota Agung Timur District, Tanggamus Regency in 2020 which states that there is no relationship found between mothers education level and the occurrence of toddlers stunting.[19] In contrast to the

findings of the aforementioned studies, research conducted in Lokus Village, Ngawi Regency in 2022 demonstrated a substantial correlation between the occurrence of stunting in toddlers and maternal formal education. The stunting's risk among children is 4,429 times fold greater for mothers with the education in low level than for mothers with the education in higher level.[11]

In comparison to an individual with a low level of education, the simplicity with which an individual can acquire information is correlated with a high level of education. Mothers who have completed a higher level of education tend to be easier in understanding and receiving information about nutrition, especially in choosing and processing healthy foods to fulfill the nutritional requirements of family members. Conversely, if the level of education pursued by the mother is low, there is a possibility that the mother is less proficient in the selection and processing of nutritious food. As a result, the nutritional needs of family members, including toddlers, cannot be fulfilled and affect the incidence of stunting.[20] The ability and talents a person possesses are determined by the level of education they have completed. The higher the parents' education, the higher their knowledge, skills and abilities are assumed to be. But knowledge can also be acquired outside of formal schooling through non-formal education including the internet, newspapers, television, and magazines, among other information media sources. Even mothers with low levels of education can benefit from easy access to materials and information from various sources, thus expanding their knowledge.[21]

In this study, the mother's education level did not affect the occurrence of stunting. The research data showed that stunted toddlers from mothers with low education levels were 45%, while non-stunted toddlers from mothers with low education levels were 42.5%, which means there is no significant difference where toddlers who do not experience stunting also occur with low-educated mothers. This is because mothers with low education do not necessarily lack knowledge about nutrition. The mother's educational attainment does not ensure the child's protection from malnutrition, as a high level of education does not necessarily equate to enough knowledge of proper nutrition.

Mother's Occupation

Referring to the results of the statistical test, it was found that the mother's occupation status had a significant effect on the occurrence of stunting in toddlers aged 24-59 months in the Pakis Aji Primary Health Center's work area. Toddlers with employed mothers have a 3.1 times greater risk of stunting in contrast to unemployed mothers. This study aligns with research carried out in Trucuk District, Klaten Regency, which states that there is a relationship between maternal employment status and the occurrence of stunting in toddlers.[20]

A mother's occupation status is a factor associated with nutritional status. Mothers who are unemployed are more inclined to supervise their children than those who are employed. Furthermore, mothers who are not employed have the opportunity to prepare nutritious meals, carry their children to health services and *posyandu* on a regular basis, and receive health education, in contrast to working mothers. Employed mothers tend to have less time to interact with their children than non-employed mothers.[20] The lack of visits to health services and eating assistance due to the busyness of mothers who work results in employed mothers tending to provide parenting to other people such as grandmothers and other relatives who do not necessarily have good enough knowledge related to nutritional status, allowing the eating patterns of children of working mothers to be disrupted. This can result in children experiencing malnutrition.[22]

History of Hypertension During Pregnancy

According to this study, there was no effect on the history of hypertension in mother's pregnancy with the occurrence of stunting among toddlers aged 24-59 months in the Pakis Aji Primary Health Center's work area. The outcomes of this research are align with a previous research done in Pidie Regency in 2020 explaining that there is no relationship between hypertension during pregancy and stunting.[23] Different results were obtained from research conducted in Sopaah District, Pemekasan Regency in 2021 shows that there is an influence between hypertension in mother's pregnancy and the occurrence of stunting in toddlers aged 24-59 months, where mothers with a history of hypertension in pregnancy have a 4.086 times risk

of stunting in toddlers compared to mothers whose blood pressure history is normal during pregnancy.[15]

Increased blood pressure during pregnancy can cause the muscle layer of the spiral artery to be stiff and hard and does not allow for distension and vasodilation which ends in vascontraction of the spiral artery. This results in decreased uteroplacental circulation..[24] Decreased uteroplacental circulation causes blood flow and nutrient flow to the placenta to be not optimal so that the mother is at risk of placental hypoxia and ischemic placental disease which can inhibit fetal growth, including the occurrence of complications in the fetus such as LBW and prematurity.[25] In addition, infants born prematurely to hypertensive mothers may experience insufficient oxygen supply in the umbilical cord bloodstream which can lead to placental resistance. This worsens the physical growth of the fetus and affects toddlerhood so that toddlers are at risk of stunting.[26]

In this study, hypertension during pregnancy did not affect the incidence of stunting. This may occur because when pregnant women are diagnosed with hypertension, they will get treatment for high-risk pregnant women and be referred early so that the impact that may arise can be prevented as early as possible. In addition, researchers assume that this study does not prove that there is a significant effect of hypertension during pregnancy on the incidence of stunting in toddlers because the majority of mothers of toddlers, both stunting and not stunting, did not experience hypertension in their pregnancy. The number of mothers who experienced hypertension during pregnancy was only 11 people (13.8%) of the total sample obtained and 7 of them had stunted toddlers, which means that 64% of mothers with a history of hypertension during pregnancy had stunting toddlers.

History of Chronic Energy Deficiency (CED) During Pregnancy

This study demonstrates a correlation between CED during pregnancy and the prevalence of stunting in children between 2 years to 59 months in the work site of the Pakis Aji Primary Health Center. Mothers who experienced CED in the pregnancy period 3.619 times tend to produce toddlers with stunting in comparison to mothers without a CED's history in pregnancy period. CED is indicated by the measurement of MUAC (mid-upper arm circumference) < 23.5 cm. This study's findings align with earlier study done in North Musi Rawas Regency in 2019, which indicates a correlation between maternal CED in pregnancy period and the prevalence of stunting in children aged 2-5 years. Mothers who suffered CED in the pregnancy period are 14.481 times tend to have stunted toddlers than mothers without a history of CED during pregnancy.[23] Furthermore, a further study carried out in Senaru District, North Lombok Regency in 2021 revealed that a mother's previous experience of CED was identified as a contributing factor to the occurrence of stunting.[14]

The nutritional status of the mother during pregnancy can affect the fetus. One of the problems of nutritional status in mothers during pregnancy that is commonly found is CED.[27] CED in pregnant women indicates that the mother is malnourished. This is due to the lack of consumption of food sources of energy that lasts for a long time. Prolonged and sustained malnutrition during pregnancy will have adverse effects on the fetus.[28] The fetus in the womb needs certain nutritional reserves to sustain its physiological needs during pregnancy, but these are not met when there is a chronic energy deficit. In the meantime, the fetus develops and grows inside the mother. The fetus responds to malnutrition in the womb and during the early stages of life by making parallel adjustments, one of which is to decrease growth by decreasing the quantity and development of body cells. An adult's short body is the manifestation of the malnutrition-induced adjustment respond. [29]

Chronic energy deficiency leads the fetus in the womb to have inadequate nutritional reserves to meet its physiological needs throughout pregnancy, which include hormonal changes and increased blood volume.[28] As the result, the fetus not getting the nutrients it needs and will be at risk of LBW baby. Babies with low birth weight are at high risk of stunting.[13]

Based on this description, it can be concluded that maternal nutrition has a significant impact on the development, growth and long-term survival of the child. Mothers are a source of nutrition for developing children, especially in the first 1000 days

of life, for this reason it is very necessary to have adequate nutrition from the mother to be able to give birth to healthy children, so that children can avoid the occurrence of stunting.

History of Anemia During Pregnancy

The condition of anemia in pregnancy where the mother's Hemoglobin and transferrin levels are low causes impaired fetal growth and development because the transfer of oxygen and Fe through the placenta to the fetus is decreased and inadequate.[14] The flow of nutrients including ferritin to the fetus during pregnancy will decrease, causing the newborn's iron reserves to be lower when compared to babies born to mothers without anemia during pregnancy. This situation will make it easy for children under two years old (baduta) to experience iron deficiency anemia. In fact, iron is a necessity in accelerating growth and development in the first thousand years of life. This puts children at risk of stunting.[30]

This study demonstrates that no correlation is present between a previous occurrence of anemia in the pregnancy period and the occurrence of stunting in children between the ages of 24 months and 59 months in the working site of the Pakis Aji Health Center. The study's outcomes are consistent with earlier research done at the Kedungtuban Health Center in Blora Regency, which indicates that no connection present between a record of anemia in the pregnancy period and the prevalence of stunting in children aged 24 months until 59 months.[30] Another study done in the workplace of the Cluwak Health Center, Regency of Pati in the year of 2021 found no major correlation between maternal anemia in the pregnancy period and the occurrence of stunting in children aged 2 years to 59 months.[31]

This research proves that the history of maternal anemia in the pregnancy period have no influence on the occurrence of stunting because pregnant women who have been detected to have anemia during pregnancy are directly intervened by Jepara District health workers by providing supplementation with blood supplement tablets (TTD), with the hope of overcoming the problem of anemia in pregnant women. In addition, based on information from the Pakis Aji Jepara Health Center, pregnant women who experience anemia are given education about guidelines for meeting iron needs and the importance of iron in pregnant women. The education includes setting a balanced diet and increasing the consumption of iron-source foods. Iron supplementation is provided in accordance with the current government standard of 90 days during pregnancy. Iron supplementation provided during pregnancy is used to fulfill the body's iron needs. Iron supplementation is considered effective for increasing hemoglobin levels because each tablet contains 60 mg Fe and 0.25 folic acid.[32]

CONCLUSION

Employed mothers and history of CED in mother's pregnancy effect the occurrence of stunting among toddlers. mothers who are employed have a risk that is 3.143 times higher of having toddlers with stunting. Similarly, mothers who experienced Chronic Energy Deficiency (CED) in the pregnancy period have a risk that is 3.619 times higher of having toddlers with stunting. Chronic Energy Deficiency (CED) in the pregnancy period is the primary maternal factor contributing to the development of stunting case in children within the worksite of the Pakis Aji Health Center, located in Jepara.

CLEARANCE

Approved by RSUD RA. Kartini Jepara, Jl. KH. Wahid Hasyim Jepara, No. SK: 001/KEPKRS/II/2024

CONFLICTS OF INTEREST

We have no conflicts of interest to disclose. All authors declare that they have no conflicts of interest.

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