8. Prenatal and Postnatal Factors Related to The Incidence of Stunting in The Coastal Area Surabaya, Indonesia

by Ilya Krisnana

Submission date: 03-Jun-2021 02:44PM (UTC+0800)
Submission ID: 1599501782
File name: ncidence_of_Stunting_in_The_Coastal_Area_Surabaya,_Indonesia.pdf (203.41K)
Word count: 4667
Character count: 25110

Prenatal and postnatal factors related to the incidence of stunting in the coastal area Surabaya, Indonesia

***Ilya Krisnana[1], Ni Made Widiani[2], Sulistiawati Sulistiawati[2]**

Sri Lanka Journal of Child Health, 2020: **49**(3): 223-229

Abstract

Objectives: To assess the prenatal and postnatal factors associated with the incidence of stunting in 6-24 month old children in the coastal area Surabaya, Indonesia.

Design: Observational cross-sectional study.

Method: Total sample of 100 included mothers and 6-24 month old children fulfilling the inclusion criteria. Multistage random sampling was used. Collected data underwent bivariate and multivariate analyses. Odds ratio (OR) and risk ratio (RR) were two commonly used measures of association reported in research studies. In cross-sectional studies, the odds ratio was also referred to as the prevalence odds ratio (POR) when prevalent cases are included, and, instead of the RR, the prevalence ratio (PR) was calculated.

Results: Stunting incidence was associated with anaemia in the second trimester of pregnancy (p=0.002, PR=3.244), history of exclusive breastfeeding (p=0.003, PR=3.938), and history of maternal iron consumption during pregnancy (p=0.006, PR=3.798).

Conclusions: Prenatal factors such as anaemia and iron consumption during pregnancy were associated with stunting. Exclusive breastfeeding was the only postnatal factor that was associated with stunting. Infants who were given exclusive breast milk had a 3.98 times lower risk of stunting compared to babies who did not get exclusive breast milk.

DOI: http://dx.doi.org/10.4038/sljch.v49i3.9138

[1]*Faculty of Nursing,* [2]*Faculty of Medicine, Universitas Airlangga, Indonesia*
**Correspondence:* ilya-k@fkp.unair.ac.id
orcid.org/ 0000-0001-8076-9036

(Received on 06 September 2019: Accepted after revision on 18 October 2019)

The authors declare that there are no conflicts of interest
Personal funding was used for the project.

(Keywords: Stunting, pregnancy history, infant history, coastal area, iron consumption, exclusive breastfeeding)

Introduction

Malnutrition associated with stunting is a significant problem[1]. One factor causing stunting is long-term malnutrition occurring during the first 1000 days of birth from the beginning of conception to 2 years of age[2]. Risk factors for stunting are prenatal and postnatal. Prenatal factors play an important role in preventing stunting and have a long impact on a child's growth[3,4]. Other factors include getting complete vaccination, lack of maternal education[5], late initiation of breastfeeding, and having an infectious disease[6]. Poor sanitation, poverty, social inequality, and food insecurity have also become factors causing stunting[7].

According to World Health Organisation (WHO) standards, stunting is a public health problem if its prevalence in the under-5 year old children exceeds 20%. Globally, stunting incidence of under-5 year old children reached one million, which was around 22%, in 2017[8]. In the Southeast Asia region, one-third of children have stunting and malnutrition[1]. The number of stunting events in Indonesia is 29.6%[2]. Basic Health Research in 2013 showed that 25% of children under five in Indonesia experienced stunting from birth, at the age of 0-5 months, which showed that the child had experienced malnutrition from the intrauterine period[9]. Based on Nutritional Status Monitoring, the Directorate of Community Nutrition reported the percentage of stunting in East Java Province was 26.7% in 2017[10]. The percentage of children under five experiencing stunting in Surabaya was 22.8% in 2017[2]. Stunting prevalence in a toddler in Tanah Kedinding Health Centre in Kenjeran District was 25.7% in 2014[11].

Maternal nutritional status during first 1000 days of life from conception, is one of the risk factors for stunting. Second trimester of pregnancy anaemia affects the baby's postnatal growth. Infants whose mothers are not anaemic in the second trimester are heavier, and have greater body length and head circumference[12]. Taking iron tablets weekly during pregnancy is related to an increase in the weight and length of the neonate. Adequate weight gain in pregnancy also contributes to weight and length of the neonate[13]. Longitudinal research results showed that low birth weight infants cannot experience

height recovery in the first year even if the baby was in a more prosperous family[14]. Giving breast milk also affects the postnatal growth of the baby. The components of protein and fat in breast milk affect the growth of a baby's length[15]. Stunted children have a much higher risk of experiencing long-term health problems than those without stunting[16]. Stunting also contributes to child mortality, morbidity, and disability, including impaired physical and cognitive growth.

Objectives

To assess the prenatal and postnatal factors associated with the incidence of stunting in 6-24 month old children in the coastal area Surabaya, Indonesia.

Method

This was a cross-sectional study. The study population consisted of children aged 6-24 months and multistage random sampling technique was used. The population areas used for the study were health centres and posyandu (integrated service post). Randomization was carried out at the community health centre level so that three health centres were obtained. Then randomization was carried out at the posyandu level, located in the three health centres, to get 10 posyandu. Each posyandu was taken with a sample of 10 samples each with inclusion criteria, namely having a complete maternal and child health (MCH) book (there were data on body weight during pregnancy, height, weight at the end of pregnancy, haemoglobin levels in second trimester of pregnancy, iron tablet consumption, baby's birth weight and length). The research instrument used was a data collection sheet. Collected data included personal information, antenatal history, baby's anthropometry and baby's dietary history.

Data collection: Based on data obtained from the community health centre, randomization was done and 10 posyandu were selected. Researchers were introduced to posyandu cadres by primary health centre officers. Researcher approaches the respondent from the cadres, who connect with the respondent so that the sample was obtained. Prospective respondents were determined by taking 10 samples that meet the inclusion criteria in each selected Posyandu. Researcher explained the purpose, benefits, participation of respondents, and guarantees confidentiality of the respondents. Respondents signed the approval sheet, then data collection was carried out. Nutritional status data based on length/age were taken by measuring body length using a length board in toddler who cannot stand and microtoise on children who can stand. Data on body weight before pregnancy and breastfeeding history were taken through interviews. Data on pregnancy weight gain, anaemia in second trimester of pregnancy, and consumption of iron tablets during pregnancy, infant birth weight and length were taken from medical records in the form MCH books.

Data analysis: In this study data was analysed using a univariate analysis test which was used to describe the frequency distribution of subject characteristics and characteristics of respondents. Bivariate analysis was used to determine the relationship between the dependent and independent variables, the statistical test used was Chi-square. Multivariate analysis was used to determine how much the independent variables affects the dependent variable and the statistical test used was multiple logistic regression ($\alpha = 0.05$). Odds ratio (OR) and risk ratio (RR) are two commonly used measures of association reported in research studies. In cross-sectional studies, the odds ratio is also referred to as the prevalence odds ratio (POR) when prevalent cases are included, and, instead of the RR, the prevalence ratio (PR) is calculated.

Ethical issues: All respondents in this study received an explanation before signing an informed consent form. Ethical clearance was obtained from the health research ethics committee of the Faculty of Medicine, Universitas Airlangga, Surabaya, with certificate no. 5/EC/KEPK/FKUA/2019.

Results

The characteristics of the children are shown in Table 1 and the characteristics of the mothers in Table 2.

Table 1: ***Children' characteristics (n=100)***

Characteristic	Number (%)
Sex	
Male	60 (60)
Female	40 (40)
Age (months)	
6-12	44 (44)
13-18	43 (43)
19-24	13 (13)

Table 2: ***Mothers' characteristics (n=100)***

Characteristic	Number (%)
Age (years)	
<20	01 (01)
20-35	86 (86)
>35	13 (13)
Education	
Elementary school	12 (12)
Junior high school	27 (27)
Senior high school	44 (44)
College	17 (17)
Job	
Employee	22 (22)
Entrepreneur	02 (02)
Does not work	76 (76)

Incidence of stunting was 28%. Analysis of factors associated with the incidence of stunting in children in coastal area Surabaya, Indonesia, is shown in Table 3.

Table 3: ***Analysis factors incidence of stunting on children in coastal area Surabaya Indonesia***

Independent variable	Incidence of Stunting *(n=28)*		Total n (%)	p *value*	PR
	Stunting n (%)	No stunting n (%)			
History of maternal iron consumption					
As recommended	10 (16.9)	49 (83.1)	59 (100)	0.006	3.789
Not as recommended	18 (43.9)	23 (56.1)	41 (100)		
History of anaemia					
No anaemia	12 (17.6)	56 (82.4)	68 (100)	0.002	3.244
Anaemia	16 (50.0)	16 (50.0)	32 (100)		
Gestational weight gain					
As recommended	09 (23.7)	29 (76.3)	38 (100)	0.601	-
Not as recommended	19 (30.6)	43 (69.4)	62 (100)		
Birth weight					
Normal	28 (28.6)	70 (71.4)	98 (100)		
Low birth weight	0 (0)	01 (100)	01 (100)	0.794	-
Very low birth weight	0 (0)	01 (100)	01 (100)		
Birth length					
Normal	25 (26.9)	68 (73.1)	93 (100)	0.396	-
Abnormal	03 (42.9)	04 (57.1)	07 (100)		
History of breastfeeding					
Exclusive breastfeeding	10 (16.4)	51 (83.6)	61 (100)	0.003	3.938
Not exclusive breastfeeding	18 (46.2)	21 (53.8)	39 (100)		

PR: Prevalence ratio

Based on table 3, there is an association between anaemia history in the second trimester of pregnancy and the incidence of stunting (p = 0.002, PR = 3.244) in children. This means that a child whose mother has anaemia in the second trimester of pregnancy has 3.244 more chance of experiencing stunting than a child whose mother does not have anaemia in second trimester. There is an association between breastfeeding history and the incidence of stunting (p = 0.003, PR = 3.938) in children. This means that children who were not given exclusive breastfeeding have a 3.938 greater chance to experience stunting than those who were given exclusive breastfeeding. There is also a relationship between the history of maternal iron consumption during pregnancy and the incidence of stunting (p = 0.006, PR = 3.798) in children. This means that children whose mothers did not take iron tablets as recommended during pregnancy have a 3.798 greater chance to experience stunting than those who received iron tablets as recommended.

The results of multivariate analysis with multiple logistic regression test are shown in Table 4.

Table 4: ***The results of multivariate analysis with multiple logistic regression test***

Variable	B	P value	Exp (B)	95% CI for EXP (B)	
				Lower	Upper
History of anaemia during second trimester of pregnancy	1.449	0.005	4.258	1.543	11.754
History of breastfeeding	1.323	0.010	3.753	1.370	10.277
History of maternal iron consumption	1.224	0.018	3.399	1.237	9.341

Table 4 shows that history of anaemia during the second trimester of pregnancy can significantly affect the incidence of stunting (p = 0.005, p<0.01). The table also shows the Exp (B) value of 4.258, which means that one whose mother has anaemia in the second trimester of pregnancy has the chance to experience a stunting incidence of 4.258 more than the one whose mother has no anaemia in the second trimester of pregnancy. Table 4 shows that the history of breastfeeding can significantly affect the incidence of stunting (p=0.010, p<0.05). The table also shows the Exp (B) value of 3.753, which means that toddlers who were not given exclusive breastfeeding had a chance to experience a stunting incidence of 3.753 greater than those who were given exclusive breastfeeding. Table 4 also shows that the history of consumption of maternal iron during pregnancy can significantly affect the incidence of stunting (p = 0.018, p<0.05). The table also shows the Exp (B) value of 3.399 which means that the number of mothers whose mothers did not take iron tablet as recommended during pregnancy

had a chance to experience a stunting incidence of 3.399 greater than those who received iron tablet as recommended.

Discussion

Pregnant women have an increased risk of anaemia due to changes in blood plasma volume and the amount of iron consumed in a meal is not sufficient, so an additional iron tablet is needed to prevent the effects of anaemia during pregnancy[17]. Our study demonstrated a significant association between the history of iron consumption during pregnancy and the incidence of stunting in children. A previous study in Nepal also showed a relationship between iron consumption during pregnancy and incidence of stunting, where children, whose mothers consumed iron during pregnancy, were taller than children whose mothers did not consume iron during pregnancy[18].

Pregnant women need more iron and so they have to get additional iron supplements. However, if a woman becomes pregnant with decreased iron reserves, iron supplementation frequently fails to prevent iron deficiency[19]. Though iron absorption greatly increases after 20 weeks of gestation, the effect of decreasing fetal growth from iron deficiency in the first trimester persists in spite of subsequent iron supplementation[20]. Weight gain during pregnancy increases due to the fetus, amniotic fluid, placenta, blood, enlargement of the uterus and breast.

Anaemia has an impact on the mother and fetus. In our study, history of anaemia in the second trimester was significantly associated with stunting incidence in child. This is similar to a previous study where there was an association of anaemia during pregnancy with stunting incidence in child[21]. A cohort study in India demonstrated that anaemia in second trimester affected postnatal growth of infants, where mothers who did not have anaemia in second trimester had babies who were longer and heavier than infants whose mothers had anaemia in second trimester[12]. A smaller decrease in haemoglobin levels from the beginning of pregnancy can be an indication of a failure to increase plasma volume during pregnancy, which can disrupt feto-placental circulation[22]. Disrupted placental flow is also related to maternal vascular dysfunction which may be involved in obstructing fetal growth[23]. The fetal linear growth rate peaks at about 16 weeks of pregnancy, followed by a decrease[24]. Besides, ultrasound measurements of growth velocity for the length of femur in a healthy fetus indicate that peak growth rate occurs in early second trimester followed by gradual decline in third trimester[25]. In our study, maternal anaemia during the second trimester may have had a significant effect on fetal linear growth.

Total body weight depends on the mother's weight before pregnancy[26]. Previous research conducted in Bogor showed no relationship between maternal weight gain in pregnancy and the baby's length[27]. Weight gain in each trimester of pregnancy was significantly positively related to infant growth. This is supported by previous studies that showed that weight gain in pregnancy affects length of the baby[28]. Research conducted in New York shows that increasing body weight each trimester has an important role in infant growth[29]. In our study, there was no specific categorization of maternal weight gain per trimester. Other research also mentions that babies with excessive maternal weight gain during pregnancy experience slower growth in the first year of life, compared to infants whose maternal weight gain during pregnancy is recommended[30]. In our study, body length of the baby was not examined every month and so it is not known whether or not in the person experiencing growth slowdown the mother's weight gain during pregnancy was appropriate or not.

Neufeld, *et al.* (2004) states that even though maternal weight gain during pregnancy can be used to predict the length of the baby, it is not significantly associated with the growth of the infant femur or tibia[24]. Besides, the gestational period is very sensitive to fetal growth. Factors related to and contributing to the growth of infants are considered to be multidimensional, for example, iron tablet supplementation, and tetanus toxoid immunization while still in the womb, maternal disease, drug treatment, alcohol, drug addiction, and smoking[31]. Infant birth weight is an important parameter for assessing the health and well-being of a newborn baby. Our study showed no significant relationship between the histories of birth weight and incidence of stunting. These results are similar to previous studies conducted in Lampung Province, where the history of birth weight was not significantly associated with stunting incidence[32]. Birth weight has a big influence on the first 6 months of a child's life, this change decreasing with age up to 2 years. The first 6 months is the right time for the baby to be able to achieve height growth to prevent stunting[33].

Birth length is the body length measured one hour after the baby is born. Birth length is a reflection of nutrition during pregnancy. In our study, the history of birth length was not significantly associated with the incidence of stunting. This is similar to previous research where a history of birth length was not a risk factor for stunting[34]. History of birth length reflects the fulfillment of nutrition during pregnancy. Children whose body length is abnormal have the potential for correction if supported by the fulfillment of nutrition during postnatal care.

Opportunities to catch up are much higher during the first 1000 days of life than after[35].

Exclusive breastfeeding is breastfeeding for six months without other food additives. In our study, breastfeeding history was significantly associated with stunting incidence. This is similar to other studies where the history of breastfeeding was associated with stunting incidence[36]. Cohort studies in West-Iranian Azerbaijan showed that infant growth increased by 0.033 and 0.72 units per unit increase in breastfeeding duration for each weight and height[37]. This study shows that under optimal conditions, exclusive breastfeeding supports the growth of babies during the first 6 months or more. Body length reflects a person's diet and health in childhood. Optimal growth and development of children require adequate nutritional support and stimulation. Breastfeeding can fulfill all the basic needs of children to grow and develop, both physical-biomedical needs (foster care), love/emotional needs (compassion), as well as the need for stimulation.

The implication of this study is that prenatal factors such as anaemia and consumption of iron tablets are factors that can prevent stunting in infants. Midwives and other health workers need to provide education to pregnant women to conduct a complete antenatal clinic, especially adherence in consuming iron tablets.

In this study there were certain limitations which have to be taken into consideration. The data obtained were secondary data, taken from data that already existed and did not explore deeply into reasons. In addition, the data obtained was historical data, so it must be remembered for a long time, and not all factors that affect stunting were examined such as genetic, hormonal, infection history, parenting, and sanitation.

Conclusions

Prenatal factors such as anaemia and iron consumption during pregnancy were associated with stunting. Exclusive breastfeeding was the only postnatal factor that was associated with stunting. Infants who were given exclusive breast milk had a 3.98 times lower risk of stunting compared to babies who did not get exclusive breast milk.

Acknowledgements

We would like to thank the mothers and children and the Head of the community health centre.

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