

# Maternal Complications during Pregnancy and Risk Factors for Stunting

## Abstract

**Background:** Stunting can be prevented by early detection when the mother is pregnant. Early detection can be carried out by looking for risk factors of stunting during pregnancy so that interventions can be early detected. This study aims to assess complications during pregnancy (disease and infection) and risk factors associated with stunting. **Materials and Methods:** The type of research was observational analytic with a case-control design on 450 mothers who were selected with simple random sampling (150 mothers who have stunting babies aged 0–2 months and 300 mothers who have not stunting babies aged 0–2 months in Malang Regency, Indonesia). This study used secondary data by looking at medical records, namely, laboratory examinations in the mother's book and cohort records at the public health center. This study was conducted from December 2021 to August 2022. Bivariate analysis with Chi-square and multivariate logistic regression was carried out to determine the variables that most influenced the incidence of stunting. **Results:** The results of multivariate analysis with logistic regression of maternal complications during pregnancy, which are a risk as a factor causing stunting, are Sexually Transmitted Infections (STIs) (Odds Ratio [OR]: 6.36; 95% Confidence Interval [CI]: 2.97–13.62), coronavirus disease 2019 (COVID-19) accompanied by pneumonia (OR: 5.12; 95% CI: 1.87–14.052), human immunodeficiency virus/acquired immunodeficiency syndrome (HIV/AIDS) (OR: 4.63; 95% CI: 1.10–19.59), hepatitis B (OR: 3.97; 95% CI: 1.253–12.565), pre-eclampsia (OR: 3.88; 95% CI: 1.81–8.30), and heart disease (OR: 3.373; 95% CI: 0.99–11.40). **Conclusions:** After recognizing the maternal factors that cause stunting, intervention should immediately be carried out on pregnant women with diseases (pre-eclampsia and heart disease) and infections (STI, COVID-19 + pneumonia, HIV/AIDS, and hepatitis B) to prevent stunting early.

**Keywords:** COVID-19, heart disease, pre-eclampsia, pregnant women, risk factors, sexually transmitted disease

## Introduction

Malnutrition happens when the baby is in the uterus and in the early days after birth. However, stunting conditions only appear after the baby is two years old. Furthermore, secondary prevention is needed through early detection so that stunting can be detected early.<sup>[1]</sup> Stunting occurs when the fetus is still in the uterus and is only detected after the child is two years old (the first 1,000 days of life). Thus, the most influential early detection of short toddlers is at first 1,000 days of life.<sup>[2]</sup>

The research was conducted in Madagascar to examine risk factors for stunting: dietary patterns during pregnancy, history of Antenatal Care (ANC) examinations, and history of multiple pregnancies.<sup>[3]</sup> Another study examined the risk factors for stunting, which were only associated with Body

Mass Index (BMI), age of the pregnant woman, mother's height, and mother's smoking habit<sup>[4–6]</sup> There were not many studies that specifically examined maternal complications that can cause stunting. Several studies that examine maternal complications that cause stunting include malaria in pregnancy,<sup>[7]</sup> pre-eclampsia,<sup>[8]</sup> syphilis,<sup>[9]</sup> and anemia.<sup>[10,11]</sup> Therefore, it is necessary to conduct research on more complex maternal complications.

People can start early detection of stunting in early pregnancy by exploring the factors during pregnancy that can cause stunting. This study looks at the risk factors for stunting as a primary ingredient, namely the risk factors for stunting from the World Health Organization (WHO)<sup>[12]</sup> and United Nations Children's Fund (UNICEF) concept of stunting causes<sup>[13]</sup> and risk factors according to several experts<sup>[7,8,9–11,14–28]</sup> and

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### Access this article online

Website: <https://journals.iww.com/ijnmr>

DOI: 10.4103/ijnmr.ijnmr\_358\_22

### Quick Response Code:



**How to cite this article:** Maulina R, Qomaruddin MB, Prasetyo B, Indawati R. Maternal complications during pregnancy and risk factors for stunting. Iran J Nurs Midwifery Res 2024;29:309-13.

**Submitted:** 19-Nov-2022. **Revised:** 10-Jan-2024.

**Accepted:** 18-Jan-2024. **Published:** 02-Jul-2024.

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obtained maternal factors, namely, infection (hepatitis B, coronavirus disease 2019 (COVID-19), Tuberculosis (TBC), Human Immunodeficiency Virus/Acquired Immunodeficiency Syndrome (HIV/AIDS), and Sexually Transmitted Infections [STIs]), as well as pregnancy-related diseases (hypertension, diabetes mellitus, pre-eclampsia, and heart disease). Previous studies in Indonesia<sup>[29-31]</sup> risk factors for stunting during pregnancy only focused on anemia and nutritional status during pregnancy. As a result, further research is required not only to assess anemia during pregnancy but also to examine other maternal complications that are risk factors for stunting. Based on the above-mentioned data, it is necessary to look for the causes of stunting, which start with pregnancy, especially pregnancy complications, so that stunting prevention can be carried out starting earlier. This research is expected to contribute to the development of midwifery service standards for stunting prevention. This study aims to assess maternal complications during pregnancy (disease and infection) and risk factors associated with stunting.

## Materials and Methods

The type of research was observational analytic with a case-control design. This was conducted in December 2021–August 2022. This study design used a case-control to study the causes of stunting during pregnancy. The number of samples involved 150 cases, and 300 control cases were selected by simple random sampling to control confounding variables, with inclusion and exclusion criteria. Inclusion criteria in this study were pregnant women taking iron (Fe) tablets regularly, relative socio-economic poverty, normal BMI, maternal height >145 cm, and birth length at the time of data collection  $\leq 2SD$  for cases and birth length  $\geq 2SD$  for control. The exclusion criteria were babies born prematurely. In this study, the researchers used a sample size of the formula from Stanley Lemeshow. The minimum sample size was calculated using the formula for case-control research, according to Lemeshow.<sup>[32]</sup> Sample size was calculated according to power analysis with  $P_1 = 0.42$  (case),  $P_2 = 0.21$  (control),  $Q_1 = 0.574$ ,  $Q_2 = 0.788$ ,  $Q = 0.681$ ,  $Z_\alpha = \text{level of significance}$ ,  $0.05 = 1.96$ , and  $Z_\beta = \text{power of the test (80\%)} = 0.84$ .

The comparison of case controls was 1:2, in which 150 mothers had stunted babies (case) and 300 mothers had babies who were not stunted (control). The sampling technique in this study was that the sample was selected by simple random sampling for both the case and control groups. The case group involved mothers with a stunting baby, and the control group was mothers with a normal baby. Identification of stunting toddlers based on indicators of height/age according to WHO Multicenter Growth Reference Study (MGRS) standards was calculated if the z-score was  $\leq 2SD$  and stated to be severe stunting if the z-score was  $\leq 3SD$ .<sup>[33]</sup> The dependent variable was the incidence of stunting (birth length < 48 cm). The independent

variables were infection during pregnancy (TBC, hepatitis B, COVID-19, HIV/AIDS, and STIs) and disease during pregnancy (high blood pressure, pre-eclampsia, diabetes mellitus, and heart disease).

The research instrument in this study employed secondary data by looking at medical records, namely, laboratory examinations in the mother's book and cohort records at the public health center. Data collection was carried out from December 2021 to August 2022 in the work area of the public health center in Malang district, East Java, Indonesia. Data selection of respondents according to the inclusion and exclusion criteria was done with the help of village cadres and midwives. Laboratory examinations were carried out in the public health center laboratory through the integrated ANC program. The results of the laboratory examinations included Bakteri Tahan Asam (BTA) for TBC examination, Hepatitis B Surface Antigen (HBsAg) for examination (hepatitis B), Treponema Pallidum Hemagglutination (TPHA)/Rapid Plasma Reagin (RPR) serology results, HIV examination, swab/Polymerase Chain Reaction (PCR) results, blood pressure, sugar levels, urine protein, and Electrocardiograph (ECG) recording results. The analytical method used was univariate, bivariate with Chi-square, and multivariable using regression logistics.

## Ethical considerations

Ethical approval was obtained from the Ethics Committee of Airlangga University, Faculty of Medicine (Reference Number: 627/HRECC.FODM/V/2022). Before data collection, respondents were provided with informed consent. Respondents participating in the research were based on their own free will and without coercion, and they could leave the research at any stage without penalty. Respondents were explained that their data were guaranteed confidentiality and would only be used for the research objective.

## Results

The results from Table 1 show that the three most common maternal complications were hypertension (19.30%), STIs (8.20%), and pre-eclampsia (7.80%).

The Chi-square test results in Table 2 showed that maternal complications affecting the incidence of stunting were tuberculosis, hepatitis B, STIs, HIV/AIDS, COVID-19, high blood pressure, and pre-eclampsia.

Table 3 of the multivariate logistic regression analysis shows that the most dominant maternal complication risk factor causing stunting was STI with 1.849 (odds ratio [OR]: 6.36; 95% confidence interval [CI]: 2.97–13.62).

## Discussion

This study evaluates maternal complications, including infections and diseases during pregnancy, which can be

risk factors for stunting. The most dominant maternal complication risk factor causing stunting was STI, which means that STI during pregnancy has six times the risk of giving birth to a stunted baby. The second maternal complication that causes stunting is COVID-19, accompanied by pneumonia means that COVID-19, accompanied by pneumonia during pregnancy five times, gives birth to stunting. The third maternal complication that causes stunting is HIV/AIDS. It means that pregnant

women with HIV/AIDS have four times of giving birth with stunting and pregnant women with hepatitis B or pre-eclampsia or heart disease, means that pregnant women with hepatitis B, pre-eclampsia, and heart disease have three times of giving birth with stunting.

There are still very few studies to assess maternal complications and risk for stunting, and several studies assess maternal complications with Low Birth Weight (LBW) conditions. Infections in mothers during pregnancy related to tuberculosis, HIV/AIDS, STIs, hepatitis B, COVID-19, and other conditions can lead to Intrauterine Growth Restriction (IUGR) and premature birth and are at risk of causing LBW. The presence of infectious diseases for a long time affects body weight and has an impact on linear growth.<sup>[27,28,34-36]</sup>

Research shows that exposure to an abnormal intrauterine environment caused by disease during pregnancy affects anthropometric, metabolic, and mental development, leading to an increased risk of disease later.<sup>[8]</sup> The results of other studies state that cardiac output is one of the main factors affecting the optimal growth and development of the fetus.<sup>[37]</sup>

Maternal complications during pregnancy can be prevented by early detection. However, this has not become a significant concern for health workers who carry out antenatal checks.<sup>[38]</sup> They prevent pregnancy complications through early detection and carry out examinations according to schedule and quality examinations.<sup>[39]</sup> Early detection is one of the existing programs at the public health center in Indonesia, with integrated ANC examination and high-risk pregnancy detection because all pregnancies are at risk and early intervention is essential for all pregnant women.<sup>[40]</sup>

**Table 1: Maternal complications**

Risk factor	Category	n (%)
TBC***	Negative	440 (97.77)
	Positive	10 (2.23)
Hepatitis B	Negative	433 (96.22)
	Positive	17 (3.78)
STIs*	Negative	413 (91.77)
	Positive	37 (8.23)
HIV**	Negative	440 (97.77)
	Positive	10 (2.23)
COVID-19	Negative	427 (94.88)
	Positive	23 (5.12)
High blood pressure	No	363 (80.66)
	Yes	87 (19.34)
****DM	Normal	427 (94.88)
	Abnormal	23 (5.12)
Pre-eclampsia	No	415 (92.22)
	Yes	35 (7.78)
Heart disease	No	437 (97.11)
	Yes	13 (2.89)

\*STIs=sexually transmitted infections; \*\* HIV=human immunodeficiency virus;\*\*\* TBC=tuberculosis; \*\*\*\* DM=diabetes mellitus

**Table 2: Relationship between risk factor maternal complications and stunting**

Maternal complications	Category	Control group n (%)	Case group (stunting) n (%)	p
TBC*	Negative	298 (99.33)	142 (94.66)	0.003
	Positive	2 (0.67)	8 (5.34)	
Hepatitis B	Negative	295 (98.33)	138 (92)	0.001
	Positive	5 (1.67)	12 (8)	
STIs**	Negative	289 (96.33)	124 (82.66)	<0.001
	Positive	11 (3.67)	26 (17.34)	
HIV***	Negative	297 (99)	143 (95.33)	0.019
	Positive	3 (1)	7 (4.67)	
COVID-19	Negative	294 (98)	133 (88.66)	0.001
	Positive	6 (2)	17 (11.34)	
High blood pressure	No	253 (84.33)	110 (73.33)	0.005
	Yes	47 (15.67)	40 (26.67)	
DM****	Normal	288 (96)	139 (92.66)	0.130
	Abnormal	12 (4)	11 (7.34)	
Pre-eclampsia	No	287 (95.66)	128 (85.33)	0.001
	Yes	13 (4.34)	22 (14.67)	
Heart disease	No	295 (98.33)	142 (94.66)	0.124
	Yes	5 (1.67)	8 (5.34)	

\*TBC=tuberculosis; \*\*STIs=sexually transmitted infections; \*\*\* HIV=human immunodeficiency virus; \*\*\*\* DM=diabetes mellitus

**Table 3: Logistics regression results**

Risk factors	B*	p	OR** (95% CI)
Hepatitis B	1.38	0.019	3.97 (1.25–12.57)
STIs***	1.8	0.001	6.36 (2.97–13.62)
HIV****	1.5	0.038	4.625 (1.09–19.59)
COVID-19	1.63	0.002	5.119 (1.86–14.05)
Pre-eclampsia	1.36	0.001	3.877 (1.81–8.30)
Heart disease	1.22	0.050	3.373 (0.99–11.39)

\*B=beta, \*\*OR=odds ratio. \*\*\*STIs=sexually transmitted infections; \*\*\*\*HIV=human immunodeficiency virus

Several research results also assess the incidence of stunting with sociocultural practices in society that are carried out by mothers during pregnancy. Therefore, it is possible to reduce stunting and examine sociocultural practices that can harm the mother and fetus.<sup>[33]</sup> In the future, it is recommended to assess sociocultural practices during pregnancy and what can cause stunting. All pregnant women must check laboratory examinations, including BTA examination, HBsAg examination, TPHA/RPR (STI), HIV examination, swab/PCR, blood pressure, sugar levels, urine protein, and ECG recording results, even without any indication. The results of this study can be used in the early prediction of stunting during pregnancy, which can predict the incidence of stunting during pregnancy so that prevention can be done immediately. The limitation of this study is that laboratory results use secondary data and only cover one district area. Suggestions for future researchers are to use primary data by directly checking laboratory results and using several different districts.

## Conclusion

Maternal complications that are at risk as factors causing stunting are STIs, COVID-19 accompanied by pneumonia, HIV/AIDS, hepatitis B, pre-eclampsia, and heart disease. Suggestions for health services and pregnant women who do the first ANC must be examined completely including STIs, COVID-19, hepatitis B, urine protein, and ECG examinations so that stunting prevention can start early in pregnancy.

## Acknowledgments

The authors would like to thank Airlangga University and the Institute of Technology, Science and Health Dr. Soepraoen Hospital for their support in conducting this research.

## Financial support and sponsorship

Nil.

## Conflicts of interest

Nothing to declare.

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