



# Maternal Age, Nutrition, and Pregnancy Count Impact Gestational Hypertension

Rifatolistia Tampubolon <sup>1\*</sup>, Kristiani Desimina Tauho <sup>1</sup>, Maya Miranthi Oematan <sup>1</sup>

## Abstract

**Background:** Maternal mortality in East Nusa Tenggara Province remains a persistent challenge for the Indonesian government, with rates significantly higher than the national average. Despite national reductions in MMR, the province's rates remain troublingly high, with hypertensive disorders of pregnancy being a leading cause. This study investigates the factors associated with gestational hypertension on Timor Island, aiming to improve maternal health outcomes and align with global health targets. **Methods:** A quantitative field survey was conducted in South Central Timor Regency, East Nusa Tenggara Province, from June to October 2023. The study involved 160 pregnant women randomly selected from medical records across four Community Health Centers. Data were analyzed using univariate and multivariate methods to explore the relationships between maternal age, Mid-Upper Arm Circumference (MUAC), number of pregnancies, and gestational hypertension. **Results:** The study found that 15.6% of respondents experienced gestational hypertension. Most were aged 20-35 years (71.3%), had normal MUAC (58.1%), and a non-risk number of pregnancies (79.3%). However, no significant correlations were found between gestational hypertension and the independent variables of age,

MUAC, and number of pregnancies. Notably, a significant relationship was observed between maternal age and the number of pregnancies. **Conclusion:** While maternal age, MUAC size, and the number of pregnancies were not direct predictors of gestational hypertension, their interplay suggests areas for further investigation. The findings determined the need for comprehensive maternal nutritional assessments and targeted interventions to manage hypertensive disorders in pregnancy. Improved data collection and primary data utilization are recommended to enhance maternal health outcomes in South Central Timor and contribute to achieving global health targets

**Keywords:** Gestational hypertension, maternal age, Mid-Upper Arm Circumference (MUAC), number of pregnancies, East Nusa Tenggara

## Introduction

Maternal mortality in East Nusa Tenggara Province has been a significant concern for the Indonesian government since the 1990s, primarily due to its persistently high maternal mortality rate (MMR) compared to the national average. In 1991, the MMR in Indonesia was reported at 390 per 100,000 live births (Tjitra and Budiarsa, 1991). However, mainland Timor in East Nusa Tenggara Province recorded an alarming 1,346 maternal deaths per 100,000 live births in the same year. Although Indonesia has significantly reduced its national MMR to 166.5 per 100,000 live births by 2021, East Nusa Tenggara's MMR remains troublingly high. It rose to 181 per 100,000 live births (17 cases) in 2021 before slightly decreasing to 163.3 per 100,000 live births (15 cases) in 2022 (Kemenkes, 2021). Despite this reduction, the province's MMR is still far from the global Sustainable Development Goals (SDGs) target of 70 per 100,000 live births by 2030.

**Significance** | This study showed factors affecting gestational hypertension to improve maternal health outcomes in a high-risk Indonesian province.

\*Correspondence. Rifatolistia Tampubolon, Faculty of Medicine and Health Sciences, Universitas Kristen Satya Wacana, Indonesia.  
E-mail: rifatolistia.tampubolon@uksw.edu

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## Author Affiliation.

<sup>1</sup> Faculty of Medicine and Health Sciences, Universitas Kristen Satya Wacana, Indonesia.

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The predominant causes of maternal deaths in East Nusa Tenggara include hemorrhage, hypertensive disorders of pregnancy, and infections. Hypertension in pregnancy, which can progress to preeclampsia, affects 2-10% of pregnancies globally and 1.8-16.7% in developing countries. According to Indonesia's 2022 health profile, hypertensive disorders during pregnancy are the second leading cause of maternal death after hemorrhage, accounting for 1,077 cases. The incidence of preeclampsia, a severe form of hypertension in pregnancy, is reported to affect 3-10% of pregnancies and is responsible for 24% of maternal deaths. In East Nusa Tenggara, the percentage of hypertension in pregnancy has shown variability: 9.3% in 2019, 13.2% in 2020, and 12.7% in 2021 (Kemenkes, 2019, 2020, 2021).

Gestational hypertension is characterized by a systolic blood pressure of 140 mmHg or higher or a diastolic blood pressure of 90 mmHg or higher, measured at least twice with a four-hour interval, and occurs after 20 weeks of gestation. Although gestational hypertension does not initially involve proteinuria, it requires close monitoring due to the potential progression to preeclampsia. Approximately 50% of women with gestational hypertension eventually develop proteinuria or other organ dysfunction akin to preeclampsia (Owaraganise et al., 2021).

Several risk factors contribute to gestational hypertension, including a personal or family history of the condition, multiple pregnancies, maternal age under 20 or over 40 years, nulliparity, an interpregnancy interval exceeding ten years, pre-pregnancy obesity, and a Body Mass Index (BMI) below 18.5 kg/m<sup>2</sup> or above 30 kg/m<sup>2</sup> at the first prenatal visit. Additionally, preexisting medical conditions such as diabetes, kidney disease, and chronic hypertension increase the risk (Hypertension in Pregnancy, 2024). Women who survive gestational hypertension or preeclampsia face an increased risk of long-term hypertension and cardiovascular mortality, including stroke. Studies have indicated that the long-term cardiovascular risks associated with these conditions are indistinguishable from those linked to preeclampsia. In fetuses, gestational hypertension can lead to intrauterine growth restriction, preterm birth, placental abruption, fetal distress, and stillbirth. Long-term health implications for affected children include a higher risk of cardiovascular diseases, ischemic heart disease, and type II diabetes mellitus (Kondrup, 2002).

Gestational hypertension significantly contributes to maternal and perinatal morbidity and mortality on Timor Island. Despite its critical impact, there is limited research on factors associated with gestational hypertension specific to Timor Island. Thus, there is a pressing need for studies investigating these factors within the local context to enable early detection and appropriate preventive measures. This research is vital for improving maternal health outcomes and achieving global health targets in East Nusa Tenggara Province.

## Materials and Methods

This study employed a robust quantitative research design to investigate the factors associated with gestational hypertension in South Central Timor Regency, East Nusa Tenggara Province. By leveraging univariate and multivariate analyses, the research aimed to provide a comprehensive understanding of the maternal health landscape in the region, contributing to the development of targeted interventions to improve maternal health outcomes.

### Research Design

This quantitative research employed a field survey method, conducted in South Central Timor Regency, East Nusa Tenggara Province, from June to October 2023. The research focused on Community Health Centers under the District Health Service. Four health centers were selected for the study: Siso Health Center, overseeing five villages; Soe City Health Center, covering six villages/districts; Nunkolo Health Center, consisting of nine villages; and Niki-Niki Health Center, serving nine villages. A total of 29 villages were included in the study, representing the regional distribution of maternal deaths on Timor Island in 2022 as reported by the Public Health Sector, Family Health & Nutrition Section.

### Population and Sample

The study population consisted of all pregnant women in the region throughout 2022. From this population, a sample of 160 pregnant women was randomly selected from medical records at the Community Health Centers involved in the research. This random sampling method ensured a representative subset of the population under study.

### Data Collection

Data were collected through structured interviews and medical record reviews at the selected Community Health Centers. Information gathered included demographic data, medical history, pregnancy history, and current pregnancy status, with a particular focus on hypertension and related risk factors.

### Statistics Analysis

Univariate analysis was employed to determine the frequency distribution of each studied variable, providing a clear picture of the prevalence of various factors. Multivariate analysis was used to test the relationships between independent variables (such as maternal age, Mid-Upper Arm Circumference (MUAC), and number of pregnancies) and the dependent variable (gestational hypertension). This approach provided a comprehensive understanding of the factors affecting maternal health outcomes in the region.

### Ethical Considerations

The research underwent a thorough ethical review by the Research Ethics Committee of the Faculty of Medicine and Health Sciences, receiving approval with the number 6/28.07/2023071801/EA/2023. Further research permits were obtained through the One Stop Integrated Service Office of East Nusa Tenggara Province and South

Central Timor Regency, ensuring full compliance with all regulatory and ethical standards. Informed consent was obtained from all participants, ensuring their voluntary participation and confidentiality of their data.

### Results

Based on the analysis of the data, several key findings emerged regarding the incidence of gestational hypertension to maternal age, duration, and number of pregnancies among the respondents. Out of 160 respondents, 15.6% experienced gestational hypertension. Most of the pregnant women were in the non-risk age category of 20-35 years, comprising 71.3% of the sample. Additionally, 58.1% of the respondents had a normal Mid-Upper Arm Circumference (MUAC), and 79.3% had several pregnancies considered not at risk. Among those who developed gestational hypertension, most were also in the non-risk age category (9.3%), had normal MUAC (10.6%), and had several pregnancies considered not at risk (11.2%). These findings indicated that even within the groups typically considered at lower risk, gestational hypertension still occurred.

Further analysis, detailed in Table 2, showed that none of the independent variables (age, MUAC, and number of pregnancies) had a statistically significant correlation with the incidence of gestational hypertension. Despite this, a significant association was found between maternal age and the number of pregnancies, suggesting an interplay between these factors that might influence the risk of gestational hypertension.

These results implied that while individual factors such as age, MUAC, and number of pregnancies might not directly correlate with gestational hypertension, the relationship between maternal age and the number of pregnancies was significant and deserved further exploration. Understanding these associations was crucial for identifying and managing risk factors for gestational hypertension more effectively, thereby improving maternal health outcomes in the region.

### Discussion

South Central Timor (TTS) is a significant district in the Province of Timor Nusa Tenggara, notable for its large area and diverse population. It comprises 32 sub-districts, 266 villages, and 12 sub-districts, with 460,116 people. The demographic distribution shows a notable gender imbalance, with 82.4% men and 17.6% women. The largest populations are found in Kota Soe and Amanuban Selatan Districts. Health facilities are well-distributed, with two hospitals in Kota Soe District and 770 Posyandu, particularly concentrated in South Amanatun District.

#### *Age and Pregnancy Complications*

Age is a crucial factor in the readiness of a woman's reproductive organs to carry a pregnancy. The age range of 21-35 years is optimal for pregnancy (Cavazos-Rehg et al., 2015). Younger women (11-18

years) face higher risks of complications such as premature birth or preeclampsia. On the other hand, women older than 37 years experience decreased reproductive organ function, which is associated with an increased risk of gestational hypertension and preeclampsia (Dong et al., 2023). The link between maternal age and hypertension in pregnancy is attributed to higher oxidative stress levels and lower nitric oxide levels, both of which impair endothelium relaxation as women age (Nath et al., 2020).

#### *Nutritional Status and Gestational Hypertension*

Measuring the Mid-Upper Arm Circumference (MUAC) is a straightforward and long-established method for evaluating nutritional status, especially for chronic energy deficiency, by assessing an individual's protein and energy reserves. Recent studies suggest that MUAC is also effective in identifying overweight and obesity, as a predictive tool for early obesity detection (Dereje et al., 2022). Overweight or obese women face heightened morbidity risks, with excess weight gain during pregnancy contributing to hypertensive disorders (Durst et al., 2016). Women with a BMI over 30 kg/m<sup>2</sup> or MUAC measurements exceeding 22-30 cm are more susceptible to gestational hypertension, preeclampsia, and severe preeclampsia (Heslehurst et al., 2011). The strong correlation between obesity and preeclampsia indicates that obese women have a 3-10 times higher risk of developing preeclampsia (Poston et al., 2016).

#### *Parity and Gestational Hypertension*

Parity, or the number of pregnancies a woman has had, is a significant risk factor for gestational hypertension. Primigravida mothers (first-time pregnant women) are at greater risk than multigravidas (women with multiple pregnancies). This increased risk is due to the incomplete formation of HLA-G (human leukocyte antigen G) antibodies in nulliparas, which disrupts trophoblast invasion of decidual tissue, leading to a higher likelihood of gestational hypertension and preeclampsia (Armalla Roslina et al., 2022). Regular blood pressure monitoring during antenatal care (ANC) visits is essential for early detection of hypertension in pregnancy.

#### *Study Findings and Contradictions*

This study found no relationship between maternal age, MUAC size, number of pregnancies, and gestational hypertension. Despite this, maternal age and number of pregnancies showed a significant relationship with a p-value of 0.427. Previous research has established that the interplay between parity and maternal age increases the risk of fatal outcomes, intrauterine growth restriction (IUGR), prematurity, and maternal complications such as placenta previa, gestational hypertension, and uterine rupture (Kozuki et al., 2013).

The absence of a relationship between MUAC size and gestational hypertension in this study contrasts with other findings that suggest

**Table 1.** Results of univariate analysis of the variables age, MUAC, and number of pregnancies based on the incidence of gestational hypertension.

Research variable		Gestational hypertension				Total	Total %
		Yes		No			
		f	%	f	%		
Age	Risky	10	6.2	36	22.5	46	28.7
	No risk	15	9.3	99	61.8	114	71.3
MUAC	Chronic Energy Deficiency	8	5.0	59	36.8	67	41.9
	Normal	17	10.6	76	47.5	93	58.1
Number of pregnancies	Risky	7	4.4	26	16.2	33	20.7
	No risk	18	11.2	109	68.1	127	79.3
Total		25	15.6	135	84.4	160	100

Source: 2023 research primary data

**Table 2.** Correlation test results of independent variables for the incidence of gestational hypertension.

		Age	MUAC	Number of pregnancies	Gestational Hypertension
Age	Pearson Correlation	1	-0,063	.427**	0,107
	Sig. (2-tailed)		0,426	0,000	0,178
	N	160	160	160	160
MUAC	Pearson Correlation	-0,063	1	-0,151	-0,086
	Sig. (2-tailed)	0,426		0,057	0,279
	N	160	160	160	160
Number of pregnancies	Pearson Correlation	.427**	-0,151	1	0,078
	Sig. (2-tailed)	0,000	0,057		0,324
	N	160	160	160	160
Gestational hypertension	Pearson Correlation	0,107	-0,086	0,078	1
	Sig. (2-tailed)	0,178	0,279	0,324	
	N	160	160	160	160

\*\* . Correlation is significant at the 0.01 level (2-tailed).

obese pregnant women are at a higher risk of gestational hypertension compared to non-obese pregnant women (Wagata et al., 2020). The pathophysiological mechanism linking obesity and hypertension involves hyperinsulinemia due to a high body mass index, leading to endothelial dysfunction (Lopez-Jaramillo et al., 2018).

Additionally, the study did not find a correlation between the number of pregnancies and gestational hypertension. This finding aligns with Parantika et al. (2021), who also found no significant relationship between gravida status and gestational hypertension or preeclampsia. Other studies suggest that the lack of association between primigravida status and hypertension may be due to complex physiological and immunological pathways (Mustafa et al., 2012).

This study did not identify significant relationships between maternal age, MUAC size, and number of pregnancies with gestational hypertension, existing literature underscores the critical influence of these factors on pregnancy outcomes. The findings highlight the need for further research to understand better the complex interplay between these variables and their impact on maternal and fetal health. This is especially important in regions like South Central Timor, where healthcare infrastructure and resources must be effectively utilized to address the population's unique demographic and health challenges.

The findings of this study in South Central Timor, maternal age, MUAC size, and number of pregnancies did not emerge as significant predictors of hypertension incidence. However, a noteworthy relationship was observed between maternal age and the number of pregnancies. To enhance future research and healthcare practices, it is recommended to prioritize primary data sources due to limitations in health service data availability, particularly regarding comprehensive maternal nutritional status assessments. Integrating additional metrics such as height and weight in routine antenatal care examinations can provide valuable insights into the nutritional status of pregnant women, thereby supporting more targeted interventions and improving maternal health outcomes in the region.

### Conclusion

The study underscores the complexity of factors contributing to gestational hypertension in South Central Timor. Despite finding no significant relationships between maternal age, MUAC size, number of pregnancies, and gestational hypertension, existing literature highlights their critical influence on pregnancy outcomes. This indicates the need for further research to unravel the intricate interplay of these variables. Understanding these associations is vital for improving maternal health, particularly in regions like South Central Timor, where tailored interventions and efficient healthcare utilization are crucial to address the unique

demographic and health challenges and achieving global health targets.

### Author contributions

R.T. formulated the study objectives, constructed the hypotheses, and revised the manuscript. K.D.T. conducted the literature review, data collection and analysis. M.M.O. wrote the results and conclusion sections.

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### Competing financial interests

The authors have no conflict of interest.

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