



THE ASSOCIATION BETWEEN THE NUTRITIONAL STATUS OF PREGNANT WOMEN AND HYPERTENSIVE DISORDERS IN PREGNANCY AT PUSKESMAS SUKASADA I

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Abstrak

Hipertensi dalam kehamilan menjadi kontributor utama kematian ibu di Indonesia pada tahun 2022 serta menempati peringkat ketiga penyebab kematian ibu di Provinsi Bali pada tahun 2023. Salah satu faktor yang berkontribusi terhadap hipertensi dalam kehamilan adalah status gizi. Penelitian ini bertujuan untuk mengkaji hubungan antara status gizi ibu hamil dan kejadian hipertensi dalam kehamilan di Puskesmas Sukasada I sebagai upaya memahami determinan perilaku sehat. Penelitian ini merupakan studi deskriptif kuantitatif dengan desain cross-sectional. Pengumpulan data dilakukan dengan teknik sampling acak sederhana terhadap ibu hamil yang mengikuti pelayanan antenatal care di Poli Ibu dan Anak Puskesmas Sukasada I (N = 50). Instrumen penelitian menggunakan data catatan medis yang dianalisis dengan uji Pearson Chi-square. Analisis bivariat menunjukkan bahwa tidak terdapat hubungan yang signifikan secara statistik antara status gizi dan gangguan hipertensi pada kehamilan di Puskesmas Sukasada I selama periode 2023–2024 (p-value = 0,376). Hipertensi dalam kehamilan dapat disebabkan oleh berbagai faktor, tidak hanya oleh status gizi. Oleh karena itu, optimalisasi status gizi maternal dan pengendalian faktor-faktor risiko yang dapat dimodifikasi merupakan komponen penting dalam strategi preventif untuk menurunkan insidensi gangguan hipertensi dan meningkatkan keberhasilan luaran kehamilan.

Kata Kunci: Hipertensi Dalam Kehamilan, Ibu Hamil, Status Gizi

Abstract

Hypertension disorders during pregnancy remains a major contributor to maternal mortality in Indonesia in 2022 and the third in Bali in 2023. One factor contributing to hypertension during pregnancy is nutritional status. This research aims to examine the association between nutritional status of pregnant women and hypertensive disorders in pregnancy at Puskesmas Sukasada I as an effort to understand the determinants of healthy behavior and the prevention of pregnancy complications. A quantitative descriptive study was conducted using a cross-sectional analytical design. Data collection used simple random sampling of pregnant women attending Antenatal Care at the Mother and Child Clinic of the Puskesmas Sukasada I (N=50). The research instrument used medical records analyzed using the Pearson Chi-square method. Bivariate analysis using the Pearson Chi-square test obtained a p-value of 0.376, which indicates that there is no statistically significant relationship between nutritional status and hypertensive disorders in pregnancy at Puskesmas Sukasada I during the 2023–2024 period. Hypertensive disorders in Pregnancy is caused by multiple factors, not just nutritional status. Therefore, maintaining optimal nutrition along with addressing other modifiable factors remains essential in preventing hypertensive disorders and supporting healthy pregnancy outcomes.

Keywords: Hypertension During Pregnancy, Nutritional Status, Pregnant Women

INTRODUCTION

The Maternal Mortality Rate (MMR) is the number of maternal deaths per 100,000 live births due to pregnancy, childbirth, or postpartum complications, which serves as the main indicator of maternal health and the quality of health services. In 2020, Indonesia recorded an MMR of 189 deaths per 100,000 live births. The World Health Organization (WHO) has set a Sustainable Development Goal (SDG) to reduce this mortality rate to 70 per 100,000 live births by 2030 (Badan Pusat Statistik, 2024).

The MMR in Bali Province in 2023 reached 63.9 per 100,000 live births. Although the MMR in Bali meets the WHO target, there are still regency that have not met the target, one of which is Buleleng Regency. The MMR data in Buleleng Regency in 2024 has increased compared to the previous year, namely 22.2 per 100,000 live births or reaching 94.8 per 100,000 live births (Maternal Perinatal Death Notification Buleleng, 2024). Several factors contribute to maternal mortality, including non-obstetric complications (40%), obstetric hemorrhage (28%), hypertension disorder in pregnancy, childbirth, and postpartum period (12%), and other causes (20%) (Dinas Kesehatan Provinsi Bali, 2023).

According to data from the Indonesian Ministry of Health (2023), the major contributor of maternal death in Indonesia is hypertension during pregnancy, with 801 cases in 2022. Meanwhile, hypertension during pregnancy occupies the third position among the leading causes of maternal mortality in Bali Province (Dinas Kesehatan Provinsi Bali, 2023). There are several factors that associated with hypertension during pregnancy, including age, family history, hyperglycemia, twins, history of chronic kidney disease, and nutritional status (Wiranto, 2021). Nutritional status can be evaluated through anthropometric indicators, particularly the Body Mass Index (BMI). Research by Landi et al. (2018) showed that an increase in BMI is positively correlated with the risk of high blood pressure. Furthermore, hypertension during pregnancy can also occur in women with poor nutritional status, especially those born with low birth weight. Consistent with this, a cohort study in Japan that after adjusting for confounding variables reported that underweight women had a 2.34-fold higher risk of experiencing hypertension during pregnancy (Wagata et al., 2020).

Nutritional status assessments based on BMI are routinely performed during Antenatal Care (ANC) visits at community health centers (Puskesmas). Preliminary observations conducted by the researchers indicated that the number of

pregnant women attending ANC services at Puskesmas Sukasada I in 2024 reached 947, of which 18 mothers had hypertension, with 2 mothers experiencing preeclampsia and 1 mother experiencing eclampsia. Eclampsia is the most severe form of hypertension during pregnancy, which can cause sudden death of the mother and fetus. The finding of eclampsia at Puskesmas Sukasada I reflects a real and unignorable potential danger. The aim of this study was to determine the association between the nutritional status and incidence of hypertension disorders in Pregnancy at Puskesmas Sukasada I as an effort to understand the determinants of healthy behavior and the prevention of pregnancy complications.

METHODOLOGY

This research utilized a cross-sectional analytical observational design, collecting data on both independent and dependent variables at a single point in time to investigate their potential correlation. The research was carried out from June to August 2025 at Puskesmas Sukasada I, Buleleng Regency, Bali.

The target population included all pregnant women who attended antenatal care (ANC) services at Puskesmas Sukasada I during 2023–2024. The number of samples was calculated based on the hypothesis testing formula for two population proportions, resulting in 50 respondents who met the inclusion criteria; pregnant women who received ANC services during the study period and had complete medical record data. The exclusion criteria included a family history of hypertension, pregnant women with multiple gestations, diabetes mellitus, or chronic kidney disease. Data were obtained from secondary sources, including the ANC registration book at the Maternal and Child Health Clinic and verified through patient medical records. The sampling technique applied was simple random sampling, selecting eligible participants from the target population.

Data collected in this study were systematically processed and analyzed using SPSS software version 27 with the Chi-square test employing a 2x3 contingency table. The Chi-square test assumptions required that cells with expected counts below 5 should not exceed 20% of total cells. In cases where the Chi-square assumptions were not fulfilled, the alternative method applied was cell merging (Sopiyudin, 2011). Ethical clearance for this study was granted by the Research Ethics Committee of the Faculty of Medicine, Ganesha University of Education, under approval number 086/UN.48.16.04/PT/2025.

RESULT AND DISCUSSION

Table 1. Frequency Distribution of Pregnant Women at Puskesmas Sukasada I

Age	Frequency (n)	Percentage (%)
<20 years old	6	12%

20-34 years old	33	66%
≥ 35 years old	11	22%
Nutritional Status	Frequency (n)	Percentage (%)
<i>Underweight</i>	11	22%
Normal	15	30%
<i>Overweight</i>	24	48%
Hypertension Disorders in Pregnancy	Frequency (n)	Percentage (%)
Yes	18	36%
No	32	64%
Total	50	100%

According to Table 1, the predominant age group among respondents was 20–34 years (66%), which is categorized as the optimal reproductive age. Most pregnant women attending antenatal care at Puskesmas Sukasada I were classified as overweight, accounting for 24 individuals (48%). Furthermore, the majority of participants (64%) did not experience hypertension during pregnancy.

Table 2. Relationship Between Nutritional Status and the Incidence of Hypertensive Disorders in Pregnancy Among Pregnant Women at Puskesmas Sukasada I, 2023–2024

Hypertensive Disorders in Pregnancy								
Variable	Yes		No		Total	Odd	ConfidenceP Value Interval	
	n	%	n	%	n	%	(95%)	
Underweight	2	4%	9	18%	11	22%	-	0,376
Normal	6	12%	9	18%	15	30%		
Overweight	10	20%	14	28%	24	48%		

In Table 2, there were 11 pregnant women who were underweight, with 2 mothers experiencing hypertension and 9 mothers not experiencing hypertension during pregnancy. In addition, there were 15 pregnant women with normal nutritional status, consisting of 6 who experienced Hypertensive disorders in Pregnancy and 9 who did not experience hypertension. Among the respondents, 10 pregnant woman (20%) who were overweight were identified as having hypertension, while 14 mother (28%) who were overweight did not experience hypertension during pregnancy.

Table 2 presents the bivariate analysis using the Chi-square test to investigate the association between maternal nutritional status and the incidence of hypertensive disorders during pregnancy. The analysis resulted in a p-value of 0.376, surpassing the conventional 0.05 significance threshold, indicating the absence of a statistically significant relationship. This outcome implies the absence of a statistically significant relationship between the nutritional status of pregnant women and the occurrence of hypertensive disorders during pregnancy at Puskesmas Sukasada I in 2023–2024.

Discussion

The association between maternal nutritional status and hypertensive disorders in pregnancy was examined using the Chi-square test on a sample of 50 participants. The statistical test produced a significance value of 0.376, which is greater than the 0.05 level of significance. These findings demonstrate that nutritional status does not have a statistically significant correlation with the incidence of hypertensive disorders among

pregnant women at Puskesmas Sukasada I. The findings of this study align with the results reported by Fatimah et al. (2024), who also observed the absence of a statistically significant relationship between maternal nutritional status and the occurrence of hypertension during pregnancy. The results of this study are consistent with research conducted by Fatimah et al. (2024) which found no significant relationship between nutritional status and hypertension in pregnant women in.Tasikmalaya City (p = 0.464). The authors attributed this finding to the influence of complex multifactorial conditions beyond nutritional status alone. Conversely, Wiranto (2021) reported a significant association between pre-pregnancy nutritional status and incidence of hypertension among pregnant women at the Puskesmas Gunungpati in Semarang (p = 0.008). In that study, nutritional status was categorized as at-risk and not-at-risk, and analyzed using a Chi-square test with a 2×2 contingency table. Similar result by Zahroh (2022) research carried out at Puskesmas Kebomas by categorizing BMI as overweight and not overweight demonstrated that pregnant women with a higher BMI were significantly more likely to develop hypertensive disorders, with a reported prevalence ratio of 4.10 and ranging from 1.52 to 11.02 of 95% confidence interval.

Although this study did not demonstrate a statistically significant association, several factors may explain this outcome. The homogeneity of the study population and the limited variability in participants’ nutritional status could have reduced the detectable differences. Moreover, hypertensive disorders in pregnancy are multifactorial conditions influenced by complex interactions among behavioral, genetic, and environmental

determinants, which may not be adequately represented by BMI alone.

Differences in research findings may be explained by uncontrolled confounding factors such as dietary habits, sodium intake, and genetic predisposition. Sodium consumption is a key modifiable factor related to hypertension in pregnancy. Wiranto (2021) demonstrated a significant relationship between sodium intake exceeding 2000 mg/day and hypertension among pregnant women ($p = 0.005$). Similarly, Fatimah et al. (2024) found that high sodium intake was significantly associated with incidence of hypertension during pregnant women in Sukamanah Village, particularly from foods such as squid, salted fish, and shrimp ($p = 0.025$).

International cohort investigations have further reinforced the influence of sodium consumption on the emergence of hypertensive disorders in pregnancy. Findings from the Odense Child Cohort revealed that pregnant women who consumed more than 6 g of salt per day had a markedly increased risk of developing preeclampsia (HR 5.68; 95% CI: 1.51–21.36) (Birukov et al., 2019). Similar data from the Danish National Birth Cohort (DNBC) revealed that reduced sodium intake during the second trimester was correlated with a lower likelihood of developing gestational hypertension. Women classified in the highest sodium intake category (median = 3.70 g/day) demonstrated a 20% more likely to develop preeclampsia and a 54% higher likelihood of experiencing gestational hypertension compared to those in the lowest intake group (median = 2.60 g/day)(Arvizu et al., 2019).

Excessive sodium intake can cause endothelial dysfunction through various mechanisms. Studies show that high sodium consumption reduces brachial artery dilation, both in postprandial conditions and after salt loading, which is also found in women with preeclampsia for years after giving birth (Weissgerber et al., 2016). This mechanism involves a decreased nitric oxide (NO) bioavailability, elevated oxidative stress, and the secretion of soluble fms-like tyrosine kinase-1 (sFlt-1), which inhibits VEGF and exacerbates endothelial damage. In addition, excess sodium increases placental oxidative stress through xanthine oxidase conversion, triggering inflammation and exacerbating endothelial damage (Asayama & Imai, 2018). This endothelial dysfunction is one of the bases of the pathogenesis of preeclampsia, which is a type of hypertension during pregnancy.

In addition to vascular mechanisms, sodium also plays a role through dysregulation of the immune system and RAAS. High salt intake increases the pro-inflammatory Th17 response while suppressing anti-inflammatory M2 macrophages, thereby causing an immune imbalance that supports the pathophysiological

process of preeclampsia (Binger et al., 2015). In normal pregnancy, the RAAS is activated to support plasma expansion and placental perfusion, whereas in preeclampsia, the RAAS is suppressed but the vascular response to angiotensin II is increased, causing stronger vasoconstriction (Washburn et al., 2015). This condition is exacerbated by increased sodium reabsorption in the kidneys, activation of ENaC channels, and the presence of autoantibodies against type 1 angiotensin II receptors, which ultimately trigger salt-sensitive Hypertensive disorders in Pregnancy (Asayama & Imai, 2018).

Another important factor that influences the risk of hypertension during pregnancy is maternal stress. A study by Annisa (2022) found that maternal stress during pregnancy was significantly correlated with hypertensive disorders, as evidenced by a p-value of 0.000. Similarly, research by Carolin et al. (2024) conducted at Puskesmas Sriamur, Tambun Utara District, demonstrated that maternal stress during pregnancy shows a significant association with an increased risk of developing hypertension ($p = 0.006$; OR = 5.211). This finding indicates that stress exposure during pregnancy was found to increase the risk of hypertensive disorders by 5.2 times compared with women who did not experience such stress.

Psychosocial and chronic stress are known to play a role in the onset of hypertensive disorders during pregnancy through multiple biological pathways. The engagement of the hypothalamic–pituitary–adrenal (HPA) axis in conjunction with sympathetic nervous activation enhances the secretion of cortisol and corticotropin-releasing hormone (CRH), promoting vascular constriction and an elevation in blood pressure (Caplan et al., 2020). Prolonged exposure to stress leads to sustained cortisol release, reducing lymphocyte sensitivity to glucocorticoids and promoting steroid resistance. As a result, alterations in the maternal immune system occur, characterized by elevated levels of proinflammatory mediators (IL-6, CRP, TNF- α , IL-1 β) and a concomitant decline in the anti-inflammatory cytokine IL-10. This cytokine imbalance triggers chronic inflammation, impair endothelial integrity and alter vascular reactivity, which in turn heighten the risk of adverse pregnancy outcomes, including preeclampsia (Traylor et al., 2020).

Furthermore, exposure to psychosocial stressors—such as social, occupational, and environmental pressures—can elevate the risk of hypertensive disorders through the mechanism of allostatic load. Allostatic load denotes the cumulative physiological strain caused by chronic stress, which damages the cardiovascular system and heightens the inflammatory response (Caplan et al., 2020). Therefore, activation of neuroendocrine–immune pathways by prolonged stress is considered a major factor in the pathophysiology of pregnancy-

related hypertension.

Apart from psychological stress, maternal physical activity constitutes another significant factor contributing element. According to Carolin et al., (2024), regular physical activity, performed for a minimum of 30 minutes per session and repeated three to four times weekly will contributes to maintaining maternal health and endurance. Consistent with this, Annisa (2022) found that inadequate levels of physical activity were significantly associated with higher rates of hypertension in pregnant women ($p = 0.000$). Carolin et al. (2024), also demonstrated that inadequate physical activity was associated with a 3.237-fold greater risk of hypertensive disorders in pregnancy compared to adequate activity levels.

Physical activity during pregnancy has a protective effect against Hypertensive disorders in Pregnancy through several interrelated physiological mechanisms. Exercise improves cardiovascular function by enhancing heart function, improving endothelial function, and modulating oxidative stress (Silva-jose et al., 2024). Physical activity, whether aerobic or isometric, can enhance nitric oxide (NO) bioavailability through the upregulation and phosphorylation of endothelial nitric oxide synthase (eNOS) and reducing reactive oxygen species (ROS), thereby improving endothelium-dependent vasodilation and decreasing vascular resistance (Larsen & Matchkov, 2016).

Moderate aerobic exercise, such as brisk walking, light jogging, or calisthenics, has been shown to reduce ROS, improve blood flow, and increase shear stress on the vascular wall, which stimulates endothelial adaptation (Skow et al., 2017). This adaptation occurs not only in active muscle blood vessels but also in the blood vessels of other organs, demonstrating the systemic effects of physical exercise. In addition, active muscles release myokines, which are cytokines and peptides with anti-inflammatory effects, that also reduce ROS production and increase NO bioavailability (Larsen & Matchkov, 2016). Isometric exercise, such as handgrip exercise, also shows a decrease in blood pressure, although the effect are mostly localized at the trained muscle, and is associated with a decrease in oxidative stress (Larsen & Matchkov, 2016). According to the Canadian Clinical Practice Guidelines, pregnant women are advised to maintain target heart rate between 140 and 155 beats per minute, depending on maternal age, with an exercise intensity that still allows for conversation during the activity. A meta-analysis by Silva-Jose et al. (2024) demonstrated that pregnant women who engaged in regular physical activity had a notably lower risk of developing gestational hypertension, with a relative risk (RR) of 0.44 (95% CI), indicating a substantial protective effect. Furthermore, physically active pregnant women demonstrated a decrease in mean systolic

blood pressure of 2.64 mmHg and diastolic blood pressure of 1.99 mmHg compared to the inactive group.

CONCLUSIONS

The results of this study reveal an absence of a statistically significant relationship between maternal nutritional status and the development of hypertensive disorders during pregnancy at Puskesmas Sukasada I ($p = 0.376$). These findings suggest that hypertension during pregnancy is influenced by multiple factors beyond nutritional status alone, including dietary sodium intake, stress, physical activity, and genetic predisposition.

Despite the absence of a statistically significant relationship, this study underscores the ongoing relevance of ensuring adequate maternal nutrition during antenatal care as a preventive measure to promote favorable pregnancy outcomes. Health workers at primary care centers are encouraged to provide comprehensive counseling on balanced nutrition, sodium restriction, and lifestyle modification to prevent hypertension and other pregnancy complications.

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